MEGA TECH PREVIEW THE PC TECH THAT'S SET TO SHAKE THINGS UP IN 2014

apc

Xmas 2013
Issue 397

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FIPP

DOES OPEN ALWAYS WIN?

APC's editor ponders whether the time for the lounge room PC has finally come.

I must admit that as a tech aficionado, it's been a little surprising to see that the release of the PlayStation 4 and Xbox One – Sony and Microsoft's first major gaming consoles in 8 years – has been met with a rather tepid response. None of the hardcore gamers I know have been chafing to rush out and buy either console – and I will happily admit to hanging in some fairly geeky circles.

It makes me wonder if gaming-company Valve's pitch to get the PC into the lounge room might have more legs than I first thought. With the company's upcoming SteamOS and associated Steam Machines, Valve is making a serious play for an the area usually dominated by Sony, Microsoft and Nintendo – and with a Linux-powered box, no less.

But can Valve really win – or even gain a foothold – when going up against such titanic opponents? Surprisingly, history might actually be on its side.

Open platforms undeniably encourage experimentation and growth and have continually dominated in the tech scene. I'm not talking about open source here either, merely platforms that invite open competition and have relatively few barriers to entry.

In the 80s and 90s, for example, it was the 'IBM PC clone' that came to dominate the computing market, with companies thriving thanks to the ability to build systems using off the shelf parts. Companies like Apple arguably offered all-in-one solutions that were slicker and better integrated, and yet the market chose DOS and then Windows.

There are perhaps echoes of that early fight in the current war for mobile platforms (where it's Android vs iOS vs Windows Phone) and were once again, the most open platform (Android) has started to dominate.

We've also seen the encouraging rise of 'maker' culture around open computing platforms within tech, including the return of cheap hobbyist PC kits, such as Arduino and the Raspberry Pi, that lets any user experiment and build an astounding array of devices. (Of course, Darren Yates's fantastic Arduino masterclass series is a great example of all the oddball things you can create with one of these... and my own brother built an Arduino-based temperature-controller for his beer brewing setup.)

Gaming, too, has been radically changing over the last few years, with the rise of indie games developers largely flourishing thanks to the open nature of PC development.

I already use a lounge room PC for media at home, so I'll give Valve's SteamOS a shot when it's released. And if it turns out to be flexible and open enough, perhaps one day soon, us PC stalwarts will finally have a lounge room box we can call our own.

Dan Gardiner
Editor
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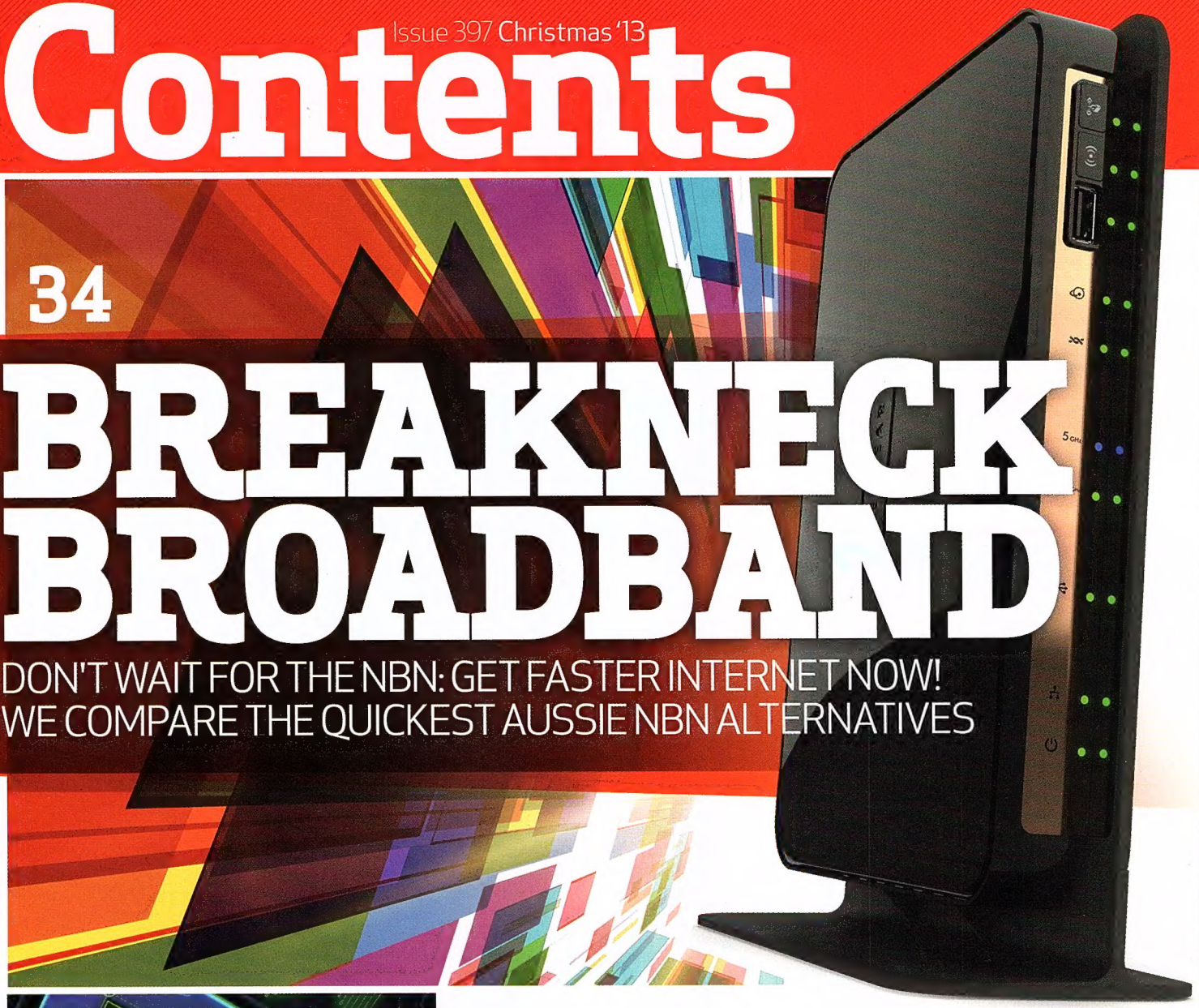

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technotes

» NEWS

I'm Watching You

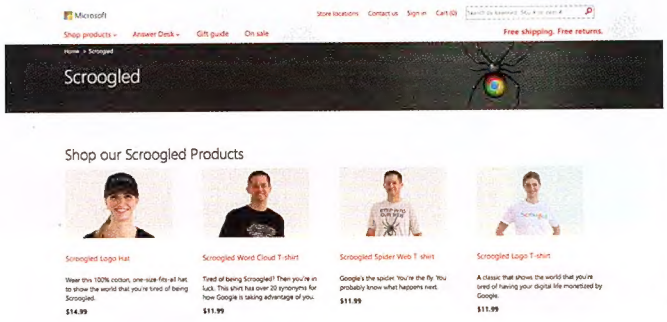
This means wear

Microsoft's anti-Google rhetoric is getting weird. Really weird.

One of the most tried-and-true ways of slighting your competitors is simply never acknowledging them: never naming, mentioning or discussing them. Companies do it all the time – playing mum on the opposition, in an attempt to reframe the conversation around themselves, with their own products and services squarely in the spotlight. Which is why Microsoft's ongoing 'Scroogled' campaign – which seeks to mock Google over privacy issues – is all the more bizarre.

The latest salvo in this unconventional marketing war is official 'Scroogled' merchandise now available for purchase from Microsoft's online store. You can buy the Scroogled baseball cap, choose from a number of Scroogled t-shirts – which all bluntly riff on how Google is taking advantage of you – or go all out on the snug-looking hoodie ("You might be getting Scroogled, but at least you won't be cold.") The comedy, if you can call it such, is hardly subtle: "Do you use Google Search? Or Gmail? Or Google Chat? Or Chrome? Then Google is watching you…all the time," goes the promo spiel. Zingers, folks!

Not that Google was above taking the bait, mind you, although its response was rather more adroit. A Google spokesperson quipped to the LA Times: "Microsoft's latest venture comes as no surprise; competition in the wearables space really is heating up."



Vale Winamp

What was the first MP3-playing software you used on your desktop? For a lot of PC users out there, the answer would be Winamp, the 15-year-old media player for Windows PCs, Mac and Linux (plus more recently Android) that once upon a time was as ubiquitous as iTunes is today. Alas, no longer: AOL, which now owns Winamp, announced that the legacy Winamp software and web site won't be supported past 2013. While the news won't likely inconvenience many users — who have in the main moved onto myriad other services — it's the end of an era for one of the mainstays of modern media playback. And there's a kind of purity to Winamp and its tight focus on the user's music collection that you won't find in today's more commercially minded offerings, be it iTunes or streaming services like Spotify. One commentator lamented Winamp's untimely passing thus: "It's resource-efficient, it's customisable... and it doesn't make me feel like it's always trying to get my credit card number." Amen.

Communication breakdown

How much do you pay for your monthly internet? Regardless of the amount, we have some bad news: it's likely to go up. At least that's what critics of the proposed Trans-Pacific Partnership Agreement — involving Australia and numerous Pacific Rim nations including, notably, the United States — are saying, after segments of the draft agreement were leaked by Wikileaks. Suelette Dreyfus, a Research Fellow at Melbourne University's Department of Computing and Information, has argued that under the controversial trade agreement ISPs will be burdened with the responsibility and expense of policing their customers' internet usage — in addition to filtering and censoring the web content they provide. In addition to curbing free speech and communication on the web, the result, Dreyfus claims, "would make access to the internet more expensive as ISPs would increase charges to cover the new requirements."

THE WORST THING ABOUT CENSORSHIP IS [redacted]

Ballmer looks back

The soon to be 'ex' Microsoft CEO acknowledges that he needs to step down for the company to move forward.

Steve Ballmer has been Microsoft's CEO for 13 years – and been an integral part for of the company for 33 years – so his August announcement that he plans to retire from the position at the end of the year came as a surprise to many.

Ballmer's tenure has been a period that's seen the rise of new businesses, such as Xbox and, for the most-part, the continued success of its mainstay Windows and Office brands.

The comparatively poor performance of Windows 8 however, combined with the company's struggle to offer compelling cloud, tablet and smartphone products have frequently been cited as reasons for the CEO's decision to step down, and Ballmer himself recently explained to the *Wall Street Journal* that change perhaps didn't come quickly enough under his tenure. He suggested that "the best way for Microsoft to enter a new era is a new leader who will accelerate change".

The WSJ reports that while the board of directors did not directly ask Ballmer to step down, they "were pushing him damn hard to go faster."

Ballmer doesn't seem to have lost all of his fire yet, however. At his last annual employee meeting, Ballmer reportedly gave high-fives and ran off the stage to "(I've Had) The Time of My Life" from the movie *Dirty Dancing*. Clearly, he's a man that knows how to make both an entrance and an exit.

The Snowden effect on business

Not just effecting cloud storage and service business, but that of hardware sellers too. In its quarterly earning call regarding the July-September period, networking infrastructure giant Cisco recently reported that it had seen a sudden drop in revenue in its top 5 emerging markets; 30% down in Russia, 25% in Brazil and 18% down in China, India and Mexico. Cisco CEO John Chambers felt China had seen the most impact from the Snowden revelations, but did acknowledge that the NSA scandal was only one contributing factor to the overall downturn. He felt that it had been "certainly causing people to stop and then rethink decisions" with regards to communications roll outs.

25,000+

NUMBER OF INDIVIDUAL HARD DRIVES IN OPERATION AT CLOUD STORAGE PROVIDER BACKBLAZE

If you guessed cloud storage operators needed a lot of hard drives to do their job, you'd be right. Backblaze recently disclosed it's got more than 25,000 drives spinning continuously to back up its customers' 75 petabytes of data (give or take a few meg). Fun fact: of Backblaze's overall storage capacity, 6 petabytes of data is stored on consumer-grade external hard drive disks that were "shucked" out of their enclosures, after the Thailand flooding in 2011 sent internal drive prices soaring.

75%

THREE OUT OF FOUR PEOPLE ARE HAPPY TO USE THEIR SMARTPHONES IN PUBLIC TOILETS

There are certain thresholds, ratios and measurements that can resonate in challenging – nay – disturbing ways. This is one of them. In a US study commissioned by LG, 75% of respondents admitted to being comfortable – or otherwise feeling no shame – in using their smartphones while utilising public facilities. Now, here at *APC* we don't judge. We merely report the facts about what you're up to. Err, that is... what *three out of four US survey respondents* are up to. Yep, that's it. There's probably no correlation with you. None whatsoever.

US$578m

AMOUNT APPLE IS PAYING FOR SAPPHIRE MATERIALS TO BE USED IN IOS DEVICES

They say diamonds are a girl's best friend, but the world's most profitable gadgeteer seems to prefer sapphires. Apple already uses synthetic sapphire materials for its iPhones – namely for camera lens covers and the iPhone 5s's much-vaunted fingerprint sensor – and with a massive US$578 million prepayment to its resident sapphire maker, GT Advanced Technologies, for a multi-year agreement, expect to see a lot more of this super-strong, scratch-resistant mineral in the future.

GLOBAL MARKET SHARE OF ANDROID PER Q3 2013

81%

We've become accustomed to seeing figures demonstrating the seemingly unstoppable gains Android is making at the expense of other mobile operating systems, but rising above 80% of global market share for the first time ever is another stunning achievement (according to IDC's numbers). And it's not the only winner, either. Windows Phone is the fastest grower, with its share of the market rocketing up 156% year on year, mostly at the expense of a dwindling BlackBerry.

THE LATEST SD CARDS SUPPORT WRITING UP TO 30 MEGABYTES PER SECOND

4K might be the (latest) holy grail of display technology, but many barriers remain – devices, cost, storage mechanisms, bandwidth etc – before the tech can hope to win over the mainstream. But now there's one less, at least. The SD Association has just announced its new Ultra High Speed Speed Class 3 cards, which support writing data at a minimum constant 30MB per second, enabling easy 4K video capture for consumer videographers with too much money and fancy equipment. And so it begins.

30MB/s

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technotes

» GADGETS

PHILIPS FIDELIO HTL9100 SOUNDBAR

$999 | WWW.PHILIPS.COM.AU

Your partner is hinting that it's time to get a new grunty home theatre system. While you don't mind that suggestion, you're just not keen on the idea of streams of messy cables around your minimalistic living room. Fortunately, you don't have to worry about that with the Philips Fidelio HTL9100 soundbar. It's unlike any soundbar you may have seen before. The speakers on both ends are detachable and wireless so you can place it anywhere around the room to achieve true 5.1 channel surround sound. It also comes with a wireless subwoofer. Despite its slick minimalistic looks, it does give a pretty grunty performance, enough to fill a large-sized living room. The clarity and depth of sound it produces is impressive even when streaming via Bluetooth. No more arguments. It's a win-win!

JOBY GRIP TIGHT STAND

$49 | WWW.JOBI.COM

Shooting with your smartphone can leave you with shaky footage, and someone always misses out because they're behind the camera filming the shaky footage. Grab a Grip Tight stand to bring some stability to your life, well… your digital life at least. The legs bend any which way and can be wrapped around anything you like to hold your smartphone steady while you're busy creating that funniest home video in the park with the dog.

BEATS STUDIO

$429 | WWW.BEATSBYDRE.COM

Just as much a fashion statement as a utility, Dr Dre's wireless flagship headphones have been taken to rehab to get into shape. Still sporting the clever, foldable design as standard, the Studio are now leaner where they need to be, comfortably padded in the other bits and robust enough for long haul travel. There's 20-hours of life in the rechargeable battery and the dual-mode adaptive noise-cancelling dynamically adapts to block out your surrounds en route to wherever dat phat-ass bass is dropping.

STAR WAR CASES FOR IPHONE 4(S)/5(S)

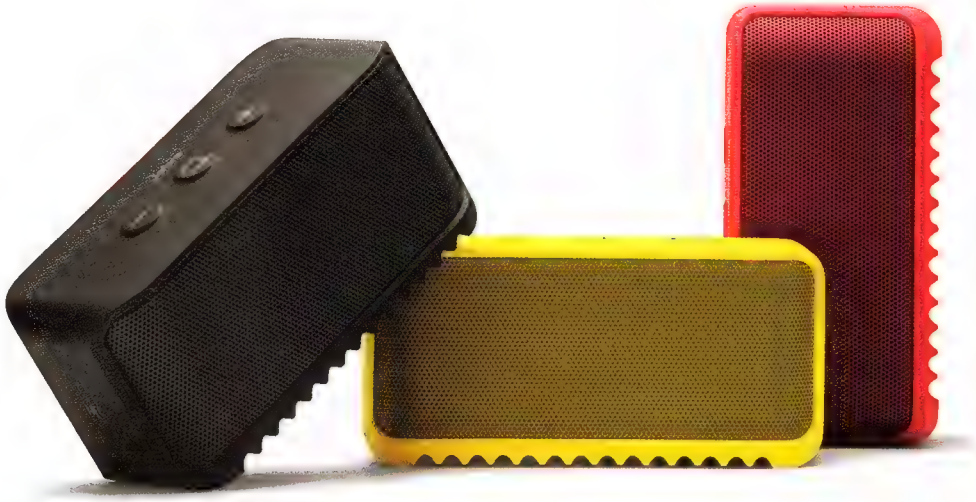
$34.99 | POWERA.COM/

We imagine you'd garner a few quizzical looks by asking someone if they want to see the tiny C-3PO in your pants. Oh how you'd laugh (at just how close you came to being assaulted) when you pull out your iPhone and flash the rigid gold Star Wars themed case. But if C-3PO is a little mincey for your tastes, there's also an R2-D2 or black Vader version available. But for our money the big winner has to be the furry (it actually is) Chewbacca case. They're available online or in select JB-HiFi and EBGames stores.

JABRA SOLEMATE MINI

$99 | WWW.JABRA.COM

There's no shortage of mini Bluetooth speakers on the market — walk into a JB, Dick Smith or Harvey's and you'll find that they all appear to be stockpiling them for an upcoming nuclear winter... But we digress. If you want one that actually sounds good and doesn't cost a fortune in bottlecaps, this one's our pick of the litter. It'll connect to pretty much any smartphone or tablet and let you stream music wirelessly to the device, which is loud enough to fill a lounge room comfortably. It's sturdily constructed and will last for about 8 hours of playback at moderate volume levels. This one's a great stocking stuffer.



GEAR4 POCKELOOPS PORTABLE MUSIC STUDIO

$69 | WWW.JBHIFI.COM.AU

Do you know a bedroom banger? Well now you can add a few extra instruments to their repertoire with this portable music studio. Watch out though, with 20 instruments at their fingertips, they can create new tracks, remix old tracks and share things instantly with you via their smartphone. Still, at least it's more interesting than the doof doof you're used to them playing for you.

Reader's letters

APC readers sound off on the latest tech issues.

NOT FULL STEAM AHEAD

I'm 56 years old and have been playing computer games since Space Invaders first hit the streets in the late 70's. I prefer FPS games and have been through lots of these on PC over the years, usually with home built or hand-me-down-modified machines, not quite cutting edge, consequently not enabling me to buy the latest iterations. That was until recently when I splurged on a gaming laptop. I haven't bought a decent game for 10 years so thought it was about time to have a look at what was on offer.

A visit to EB Games found me staring the 'cheap-out-of-date' table. After checking that they will run on Windows 8 64-bit (and not reading the fine print, i.e. 'High speed internet connection required') I bought Max Payne 3, Far Cry 3, Sniper Ghost Warrior and a brain game.
Race home, load the games and shoot bad guys 'til the wee hours, just like in the old days — right?, WRONG!

I live in a rural area, so when I found out that these games would not work until I signed up online, created an account and registered the product key, then wait for downloads which blew my monthly 5GB data allowance, only to find they still didn't work — it was infuriating.

After hours of Googling I found a fix for Ghost Warrior, Max Payne finally worked after God knows how many updates and patch downloads, but the brain game hasn't worked from day 1. Because of my physical remoteness I contacted EB Games but they don't have a 'Return by Post' policy so I'm stuck with them.

So I'm finally up and running, and love Ghost Warrior, like Max Payne and am frustrated with Far Cry 3. I can play these games without being online, but some of the game features aren't available offline! I don't want to be part of an online community, I don't want to join an online social club, I don't want to play against someone else, I don't want to have to pay more money for features/weapons/secrets/levels that should be available from initial install, I just want to load and play a game the way it used to/should be.

I have been a regular reader to APC for 20 years and a recent article (September 2013 page 82) prompted me to have a whine about this. I'm sorry Ashton Mills but "Steam, how I hate thee!" It looks like my gaming days are drawing to an end, if this is the future.
Name withheld

One reader laments the online-activation requirement and large patches required by today's PC games.

DO WHAT WHEN?

After upgrading to Windows 8.1 I found the File Explorer was misreporting file date/times. The solution was to adjust the clock Time Zone to UTC + 10.00 for Sydney and turn off the Internet Time syncing (as it was out by 1 hour) and turn off the automatic daylight saving adjustment. Also Automatic Updates was turned on so this also had to be adjusted.
Spencer Smith

START IT UP

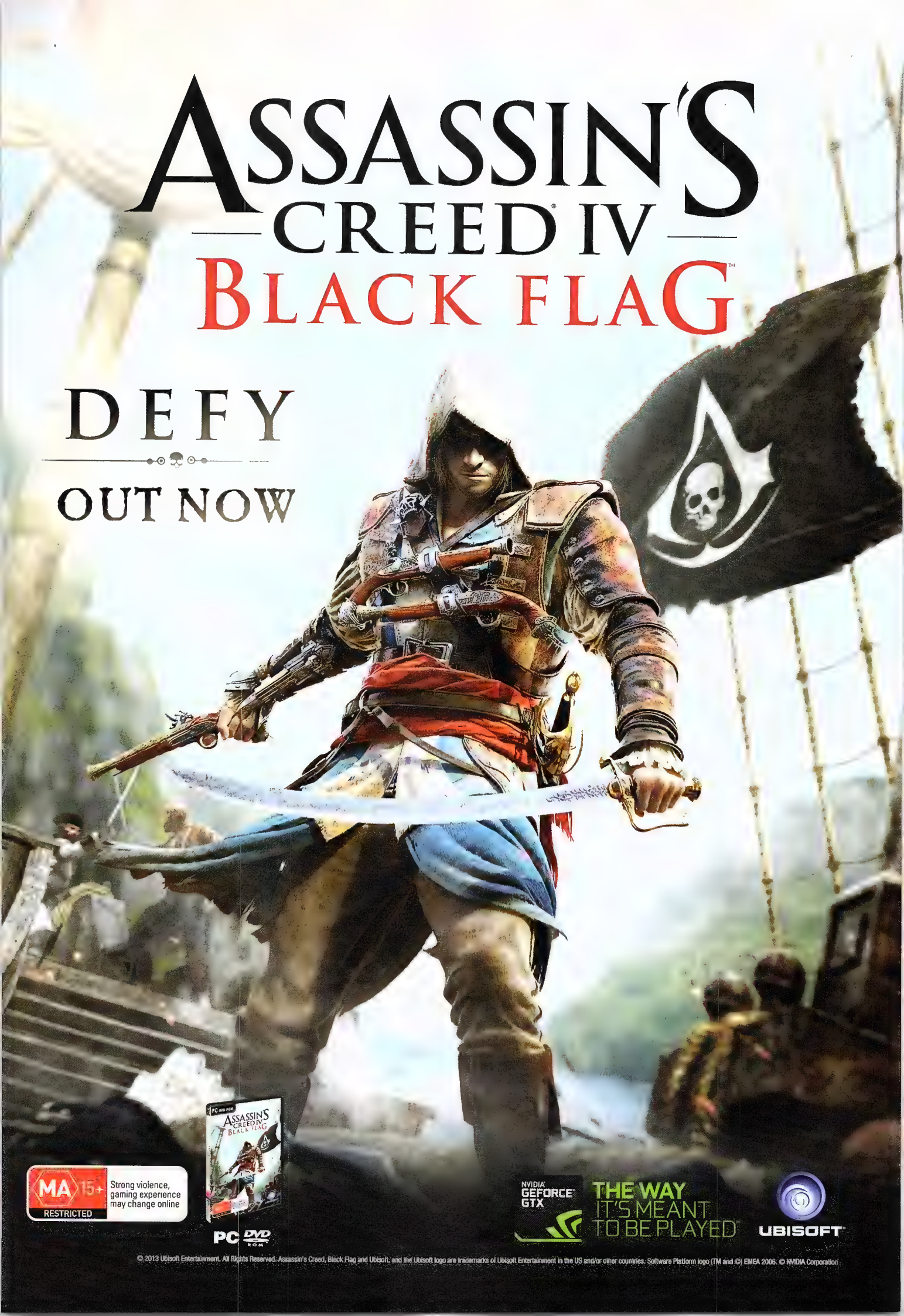
Regarding November APC's article on page 56 by Ashton Mills, the first part of the article "Starting with Start" is talking about getting the classic Start Menu put back. As well as the ones mentioned by Ashton, there is another one that is very good and free. It's called Start Menu 8 by IOBit (www.iobit.com/iobitstartmenu8.php).I thought it might be helpful for your readers.
Peter

After no Start menu for so long, there's now a littany of ways to get it back.

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to **apcmag@futurenet.com**. All correspondence becomes the property of APC and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.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Mapping the future

Pilloried at launch, are Apple's once-controversial Maps having the last laugh?

Product releases don't come much more ham-fisted than Apple Maps, released as part of iOS 6 in the latter stages of 2012. Riddled with errors, implausible (even dangerous) directions and mislabelled locations – not to mention strange visual bugs that made landscape imagery look fractured and melted – the incident was one of Apple's biggest PR blunders in recent memory. And yet, now that the dust has settled, it seems Apple won big after all. Going off a recent comScore study, the *Guardian* points out that Apple's attempted coup of Google Maps was a success that ended up costing the search giant some 23 million users. Despite the launch bugs it seems the overwhelming number of iPhone and iOS users simply stuck with Apple's built-in Maps effort in the long term and didn't seek out Google's updated iOS Maps app (behaviour no doubt helped along by iOS's largely non-customisable default actions, which always turn to Apple apps, not a third party).

Never underestimate the power of people's inactivity. After such a disastrous launch, Apple Maps still put a sizeable dent in Google's users.

CANDIDATES FOR FAILURE?

We've discussed before in End User the importance of locking down your social media profiles, but it seems some people never learn. New research conducted by Kaplan Test Prep examining college admissions processes in the US has found that 29% of admissions officers say they have Googled college applicants, while 31% have visited candidates' profiles on social networks like Facebook and Twitter. More disturbing however – than the fact this is a growing trend for employers and academic institutions – is what these people are finding when they look. In Kaplan's research, 30% of admissions officers reported finding material on the web and social media that negatively impacted on applicants' admission chances!

THE 'INTELLIGENCE' COMMUNITY

But just in case you thought digital naivety was something particular to youth, guess again. New revelations in the continuing saga of Edward Snowden have demonstrated that certain members of the so-called 'intelligence community' may not deserve that particular designation. Reuters has uncovered that Snowden, during a month-long operational stint at an NSA facility in Hawaii in 2012, was able to persuade between 25 to 30 (!) colleagues to hand over their logins and passwords, citing he needed them for his work as an IT systems admin. The passwords are thought to have given Snowden access to all sorts of classified material he was not otherwise authorised to access.

LOST IN SPACE

But this month's most astonishing gaffe has to go reported claims that a Russian astronaut carried a malware-laden USB stick into space and *unwittingly infected the International Space Station*. According to claims by Eugene Kaspersky, founder of the antivirus and security software suites, the incident – which is thought to have occurred several years ago when PCs on board largely ran the highly exploitable Windows XP – resulted in "virus epidemics", which may have involved the contamination of dozens of notebooks. Where's Ripley when you need her? ■

ENDUSER

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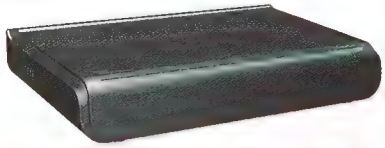

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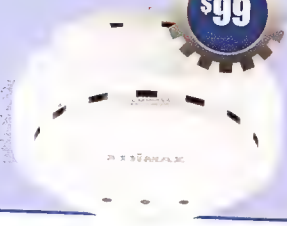

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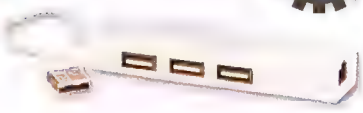

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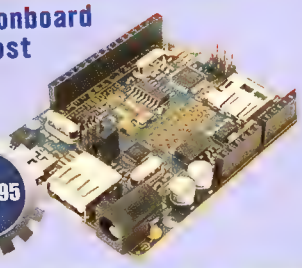

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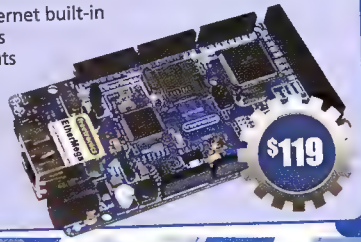

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technotes

» HOW IT'S DONE

4 The near field communication (NFC) chip is housed in the tablet's rear.

1 While the battery tray is easy to remove from the tablet, watch out for the thick glue holding the battery to the tray.

2 The front panel LCD ain't going anywhere without the use of a heat gun.

3 A single integrated circuit is the only chip on this daughter-board. The rest of the chips are on the motherboard (right).

Google Nexus 7

The original Nexus 7 has had a bit of a refresh, so of course we pulled one apart to check out the new goodies inside.

BACKGROUND

The follow-up to the original Nexus 7 is not only thinner, narrower, and taller than its predecessor, but it also adds a rear-facing camera and an upgrade to stereo sound. Here's what it looks like inside.

MAJOR TECH SPECS

- 1.5GHz Qualcomm Snapdragon Pro S4 processor
- 7-inch 1,920 x 1,200 IPS LCD screen
- 2GB of RAM
- Adreno 320 GPU
- 5MP rear-facing camera
- 1.2MP front-facing camera
- Android 4.3 Jelly Bean

KEY FINDINGS

- Rejoice! All we need to open this tablet is a plastic opening tool. The first glance reveals a huge battery, the standard for tablets these days.
- Although inductive charging has been around for a while, this is the first time we've seen it in a tablet since the HP TouchPad. We're pleased with the trend, as it may help eliminate wires as a source of e-waste in the future.
- Seals cover two of the screws in the Nexus 7 — one on each of the main boards — so replacing either board will likely void your warranty.
- The battery tray comes out, no problem. The tray is held in place by only a few screws (yay!), but the battery is secured to the tray with pretty sticky adhesive (boo!).
- Then, out comes both the daughterboard, which houses a single IC nested among the connectors, followed by the motherboard, which holds all the other chips controlling this device.
- The front- and rear-facing cameras are easy pickings, as are the updated speakers. Speakers removed, we find the rear of the front panel, home to the Wi-Fi antennas.

REPAIRABILITY SCORE: 7 OUT OF 10

The rear case is very easy to open, and requires minimal prying effort with a plastic opening tool to remove… but we cracked it, even though we were quite careful during the opening procedure. All fasteners inside are Phillips screws. While the battery enclosure is easy to remove, some patient spudgering will be necessary to peel the battery off the tray. The front glass is adhered to the display frame, meaning you'll need a heat gun to get the LCD out — or be forced to replace the whole front panel. ■

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TABLET

SURFACE 2, FROM $529; SURFACE PRO 2, FROM $1,019 | WWW.MICROSOFT.COM/SURFACE

MICROSOFT SURFACE 2 & SURFACE PRO 2

Microsoft tries to smooth out the cracks in its original Surface offerings.

If you thought Microsoft needed to do something radical to stake its claim in the tablet wars, its new models likely won't impress. The company is sticking to essentially the same strategy as last year, offering up two quite different Windows tablets that happen to share the same family name. If you looked into the original models you'll know the story here; the Surface 2 is the successor to last year's Surface RT (the poor market performance of the latter has seemingly led Microsoft to drop the confusing 'RT' moniker) and runs on ARM-based hardware – in this case, the Nvidia Tegra 4 that we've seen in a handful of other devices. The Pro 2 is built on Intel's latest ultrabook laptop tech, meaning it's a grunty little unit that runs the full version of Windows 8.1 Pro but one that has better battery life than its forebear.

So what does Windows 8.1 change, exactly? While Microsoft did make a few adjustments geared towards desktop users with the 8.1 update, they also fleshed out the capabilities for touch devices, giving you access to more settings, features and customisation options in the Modern UI. For tablets, that means you'll have far fewer reasons to go diving back into the desktop interface. Overall though, this is a release that's more about fine-tuning than radical changes; it smooths down a few of the rough edges and is, overall, perhaps a little more likeable than its predecessor.

BUILD QUALITY

As with their predecessors, the second-gen Surfaces feel quite robust. Microsoft's use of a specially-designed magnesium alloy for their chassis' means they feel rock solid. Unfortunately, they also tend to feel as heavy as rock too. 'Slates' is the perfect word to describe these tablets – though they don't look particularly weighty, if you've ever picked up a piece of a slate roofing tile, you'll know that unexpectedly-heavy feel when you take one in your hand. In the performance vs portability battle, portability comes off a very poor second best – on their own, the Surface 2 weighs 656g and the Pro 2 takes that close to a kilo at 922g. Throw in a Type cover (still our preferred keyboard attachment, though it costs a rather hefty $150) and you'll add another 266g. For the Pro 2, that's really ultrabook territory.

The Surface 2 tends to wear a bit better than the Pro 2, due to the latter being painted. That black coating tends to scratch when you throw the Pro 2 in a bag and our test unit came away a little worse for wear over the three weeks we used it.

USABILITY

One thing we can't fuss over, however, is performance. Both these units are very snappy with their respective version of Windows 8.1 – they're quick to boot up, open apps and games, and provide search results from the Start screen. The Tegra 4 at the heart of the Surface 2 is one of the fastest ARM chips currently available and it's been paired with a 1080p screen, but in battery life testing it still held up well, hitting 9:46hr in our video test. (We streamed ABC News 24's live video via a web browser, due to Windows 8.1 RT not supporting our regular Windows benchmarks.)

Likewise, the Pro 2 simply flies – but with a Core i5-4200U processor and 4GB of RAM to run the show, it's no wonder. Battery life in PCMark 8's simulated workloads for Home and Work saw the Pro 2 lasting between 3:16hr to 4:31hr.

There are some areas where using a Surface is a genuinely great experience.

An optional docking station is due out in early 2014 and there's a newly revised 'Surface Edition' of Microsoft's bendy Arc Touch mouse available as an optional extra too.

The Type keyboard is first-rate, with nice large keys with a good amount of travel (considering the depth) and are comfortably firm. The Pro is a great tablet for taking handwritten notes too – when you're writing on-screen with the pen, touch input is deactivated, letting you rest your hand anywhere on the slate's display without it messing things up.

If you do have to use the onscreen keyboard, it is at least nice and big too – the 10.6-inch, 16:9 screens here are wider than you get on the iPad, meaning big-fingered folk should still be able to screen-type in relative comfort.

Windows 8.1 still suffers a little from the problem of low information density in its Modern UI. In places, Microsoft seems to have confused 'simple to use' with just 'simple', with less options and features available than we'd often like. Their heavy weight also means both are a chore to hold up for long periods.

What also hurts is a lack of storage space. The base model 32GB Surface 2 provides only 18GB of usable space out of the box – though you can add more via a microSD card slot hidden under the kickstand. Given that the Surface 2 is limited to downloading and installing apps from the Windows Store, that limitation isn't quite as restrictive as on Pro 2 (where the 64GB model leaves 37GB of usable space), but if you want to load it up with games or other large apps that's very quickly going to be limiting. And with the Windows Store finally having bulked up its range of tablet apps, there's now more chance of the latter actually happening.

And getting back to the Pro 2, we've got to say that the 64GB model really doesn't have enough to let you really get the most of what's on offer. This higher-end Surface does have enough to it that it could replace a laptop and, with a desktop dock, perhaps even become the primary computing device for business users. But you'll really need the 128GB ($1,129) or 256GB ($1,469) versions to make that a realistic proposition if you're interested in taking all your files with you and still having room for apps too.

OFFICE

Being able to use Microsoft Office is, of course, a cornerstone of Windows' appeal. The Surface 2 includes Word, Excel, PowerPoint, OneNote and now Outlook (which the Surface RT did not) in a faux desktop environment. (We say 'faux' because, as mentioned above, Windows 8.1 RT won't actually install apps from anywhere but the Windows Store, and they're only allowed to run in the Modern UI. There's no backwards compatibility for older Windows programs – for that you'll need the Pro model.)

All these Office apps are near-identical to their regular 2013 counterparts, and while you can use them using the onscreen keyboard and your fingers, the small interface elements (even with the 'extra spacing' option you can optionally turn on) really does demand a mouse cursor's precision.

The Pro 2 only includes a 30-day trial to Office 365 (the subscription-based version of Office), so you'll need to pony up if you need it beyond that.

WHAT'S A TABLET FOR?

The new Surfaces do ask some important questions – like, for one, what do we really want in a tablet? Is the most important thing portability? If that's the case, then both these new models are still wanting. Is it something to replace your laptop and potentially desktop? Here the Surface's have more solid ground to stand on – the Pro 2 in particular.

As hybrid computing devices geared towards productivity tasks, these new models do help increase the appeal of Windows as a tablet platform – if only a little. With Apple showing that you can get competitive performance in a much smaller and lighter package – all while the Surface's stand still in the latter area – it still feels as if Microsoft has a long road ahead of it if it wants to catch up.

MICROSOFT SURFACE 2

Verdict

Features	★★★★☆
Performance	★★★★★
Value	★★★★☆

While better hardware at a slightly lower price help the appeal, limited storage space, high weight and only an average range of third-party apps it's still a hard sell.

★★★½☆

MICROSOFT SURFACE PRO 2

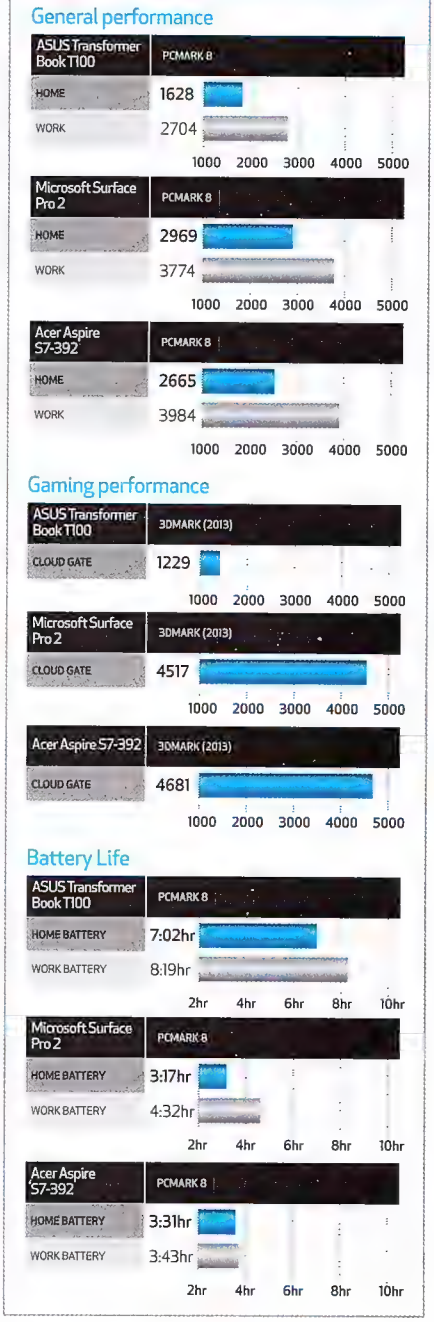
Verdict

Features	★★★★★
Performance	★★★★★
Value	★★★★½

Provided you can put up with the high weight and price, as a business-oriented tablet the Surface Pro 2 has no equal.

★★★★½

LABS BENCHMARK RESULTS



TABLET

IPAD AIR, FROM $598; IPAD MINI, FROM $479 | WWW.APPLE.COM/AU

APPLE IPAD AIR & IPAD MINI WITH RETINA DISPLAY

Apple scrambles back to the top of the tablet heap.

Whether you like or loathe the company, it's hard to dispute that Apple is still the king when it comes to tablets, with its market share hovering around the 30% mark just before the release of these new models. With the most mature tablet ecosystem and a year's head start on everyone else, it's easy to understand why. And while the iPad Air and Retina-sporting iPad Mini don't quite blow all the competition out of the water, they do enough to beat back the more recent Android (and Windows) upstarts until the eventual 2014 refresh tools around.

MORE THAN HOT AIR

To us, the Air is the more appealing of the two – and the one that's better value. The most significant change – and one you immediately feel – is the lower weight of the iPad Air. It may not sound revolutionary, but the redesigned Air (whose new chassis makes it look like a blown-up Mini) has dropped around 180g from its predecessor, going from around 650g to 470g and making it lighter than any other 10-incher our there. Physical comfort can make a huge difference to the usability of a device and here it really pays off, resulting in a tablet that's light enough to be thrown it in a bag and hardly feel the weight. It's likewise a device that's not a chore to just pull out when needed, or hold in one hand for prolonged periods.

And Apple's new 64-bit ARM A7 processor (a dual-core unit running at 1.4GHz) absolutely flies along, running on the back of a new 64-bit version of iOS. A sprinkling of apps can also already take advantage of those headroom upgrades – iMovie, for example, supports more audio and video tracks and can show editing changes in real-time to 1080p footage. (Apple's made it relatively easy for developers to port their apps to the 64-bit architecture too.)

About the only gripe we have with the design is that the thinner bezels on the sides of the screen (when held in portrait mode) do make it slightly fiddlier to hold onto, though the lower weight does somewhat mitigate the lessening of grip space.

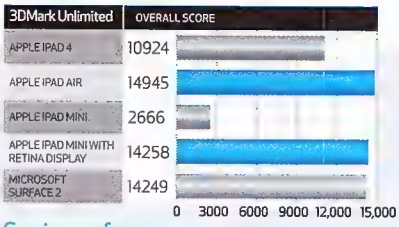
Otherwise, this new model is relatively similar to last year's – that all-important display (9.7-inches at 2,048 x 1,536), for example, is essentially identical, producing clean and sharp images with solid contrast and colour balance. Battery life was actually slightly improved over our iPad 4, lasting 11:56hr compared to 10:27hr in streaming video playback.

NEW MINI

Though it might not look it on the outside, the iPad mini has arguably copped an even more serious upgrade than its bigger sibling. The internals have jumped from being roughly on par with an iPad 2 up to almost matching the iPad Air – they both use the same CPU and GPU combined with 1GB of RAM, though the Mini's are clocked marginally slower (1.3GHz in the case of that A7 processor). Those changes actually mean it's a tad heavier than before – 340g vs the older model's

LABS BENCHMARK RESULTS

Gaming performance



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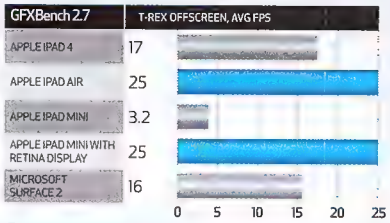

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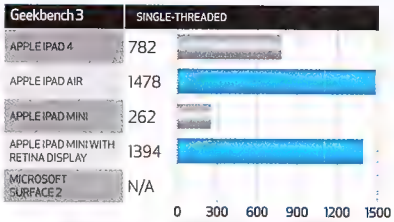

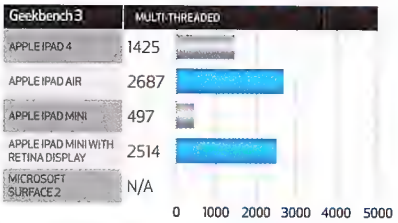

320g – but that's not quite enough to make a noticable difference.

The change that current Mini owners will notice is that new screen. While it's copped some flack online for not being great when it comes to colour and contrast, when compared side-by-side with an original Mini, the visuals on the Retina unit are clearly superior. There's the expected bump in sharpness, and with the smaller size of text on that 7.9-inch screen, that can mean less zooming is required; we found fine details looked less smeared too. Contrast was likewise superior, adding more depth to scenes (both light and dark) in our test videos. The one downside was that the reds weren't quite as deep on the new model – leading to things like skin tones looking marginally paler. Admittedly, those are things that only really have impact in direct comparisons – in regular use it's essentially unnoticeable.

As with the Air, battery life was likewise impressive, managing 10:04hr in our streaming video test. The original Mini's less-demanding hardware lasted 10:57hr.

WHICH ONE?

The main argument against the new Mini is that price. The original model was already comparatively costly for its size, and the extra $110 on top of that price (taking it from $369 to $479) puts it significantly above the likes of Google's recently-refreshed Nexus 7. Apple's clearly happy to charge a premium for its device, and while the almost entirely new hardware does go some way to justifying that stance, the smaller screen ultimately doesn't offer as much flexibility as the full-size iPad Air.

Unless you categorically need that more compact size, the Air's larger screen does confer benefits for both entertainment and productivity. Text is rendered larger making it more legible, for one, and the bigger onscreen interface elements (such as keyboard keys) are less fiddly to activate. For an extra $120, the Air'd be our choice as the more well-rounded option. Still, it's hard to argue that these are two almost equally-competent tablets that do cater to different usage models.

On the other hand, this leaves Google's 2013-model Nexus 7 virtually unchallenged at the budget end of the scale. If you've only got $300 to spend, the 16GB model is still an absolute steal at that price.

Dan Gardiner

IPAD AIR

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★½

A great all-rounder, with excellent performance, first-class battery life and a mature tablet ecosystem to back it all up.

★★★★★

IPAD MINI WITH RETINA DISPLAY

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★½☆

Sporting essentially all the features of the Air but in a smaller package, this is the king of mini tablets.

★★★★½

TABLET

$529 | WWW.ASUS.COM/AU

ASUS TRANSFORMER BOOK T100

ASUS offers another option for those seeking a budget Windows 8.1 tablet.

Microsoft may only offer two official Windows tablets, but there's actually a third way you can go – with the low-cost T100 typifying what you can expect. Microsoft is seemingly not interested in pursuing this line itself and that's frankly a little perplexing to us because, in many ways, the 10.1-inch T100 gives you the best of both worlds. It blends together a lightweight device with long battery life and the ability to run the full unimpeded version of Windows 8.1, so you can still bring all your old programs along for the ride.

The T100 manages this by using an Intel Atom x86 processor (the 1.33GHz Z3740), rather than the ARM chip in the Surface 2. It's not the first to do so – there were Windows 8 tablets last year that made the same promises as this one. But to be honest, we weren't particularly impressed with the first-generation offerings; while they managed quite competitive battery life (around the 8 hour mark for a 10-inch model), those we tested in the Labs were typically slow and laggy, with frequent delays when launching apps and executing commands, often leaving you waiting. With Intel's new tweaked Atom design however, it's managed to reduce that problem to a good degree – enough that it's worth considering one of these in place of a Surface 2.

While the performance on offer here obviously isn't as good as you'll see on a Surface Pro 2, and there is slow down on certain occasions (resizing program windows with fluid layouts often resulted in stuttery performance) that Atom chip paired with 2GB of RAM and 64GB of internal storage has enough grunt here to do the basics (and then some), but also enough battery life to last a full day; on the tougher PCMark 8 Home and Work tests, it lasted a respectable 7-8 hours. (See the Surface reviews on page 20 for the T100's full benchmark results.)

We weren't quite as enamoured with the T100's build quality – while the tablet itself is quite solid, it's still a little plasticky overall and the power and volume buttons are a tad ephemeral and wobbly to the touch. The included keyboard dock is also a bit less impressive than we're used to seeing from ASUS; it doesn't have an extra battery (which at least keeps it light weight), the keyboard keys are quite small and the trackpad button was quite stiff and hollow-sounding when pressed. ASUS had to cut costs somewhere to keep that retail price low, we're guessing.

Speaking of which, this particular 64GB model sells for US$399 in the States, so there is a bit of a mark up here – compared to what else is on offer, it's still relatively good value for a do-all tablet, however, with an adequate 1,366 x 768-pixel screen and a reasonable weight of 550g for the tablet and 520g for the dock.

This isn't the best or worst Windows 8.1 tablet around, but it does give an interesting 'middle-road' option if you're not keen on forking out a grand for a Surface Pro 2, but still want a machine that provides backwards compatibility.

Dan Gardiner

Verdict

Features	★★★½☆
Performance	★★★★½
Value	★★★★½

It's not as quick as a Surface Pro 2, but this reasonably priced and lightweight Windows 8.1 tablet still has some charms.

★★★½☆

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AUDIO-TECHNICA ATH-AG1

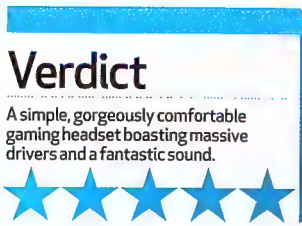
It's not a Japanese-designed headset without a little monstrous gigantism.

When designing the ATH-AG1, I imagine the head-overseer over at Audio-Technica spread the competition's bits, bobs, gadgets and attachments across the table, promptly flipped it, then held aloft a set of monster 53mm drivers while laughing maniacally.

Taking design cues from their long-standing premium audio-range, the closed-back AG1 looks impressively improbable. Two Mothra-sized, tough plastic cans with hinged, self-adjusting wings are slung between twin, rigid struts; in the gaming peripheral world, the closest comparison we can make is the super-comfortable SteelSeries Siberia with its slung headband. For our money however, the AG1 pips out the Siberia's set-up in the comfort stakes, as the wings are barely noticeable on the noggin. Rounding out the features is a prehensile unidirectional mic on the left can, a 2m extension cable to accommodate all environments and a tiny, optional and unnecessary USB DAC amplifier. It really is all about those 53mm drivers though and boy-howdy do they deliver. Sonically they're exactly what we expected from Audio-Technica; amazing gaming, music or movie audio out-of-the-box with no processing, amplification. For the number crunchers, the AG1 boasts 5-35KHz response, 100dB/mW sensitivity and a 38 ohm impedance. On the downside (and we're being picky), we would have liked to have seen an option to self-adjust the wing tension and no matter how great, it is expensive at $349. Regardless, the AG1 is an amazing set of cans geared toward gamers who are looking for nothing more than audiophile-quality sound, and with 4K gaming and next-gen consoles upon us, that should be... well, everyone. ■ Troy Coleman

Verdict

A simple, gorgeously comfortable gaming headset boasting massive drivers and a fantastic sound.



MECHANICAL GAMING KEYBOARD

$99 | WWW.TTESPORTS.COM.AU

Tt ESPORTS POSEIDON

It's like pumping iron for your fingers.

I don't always agree with our beloved Editor; mostly because he's quite plainly out-of-his mind, and you only have to take a look at our last issue to see the root of one of our more heated arguments: Which colour of mechanical switch is best for gaming? (He is clearly wrong — nobody sane likes Brown.)

So this month, it drops to me to take a look at Thermaltake's Blue mechanical-switch appointed Poseidon. Out of the box, the Poseidon looks and feels very much like Coolermaster's excellent QuickFire XT (I literally confused the two on a number of occasions) but saves thirty bucks in the process.

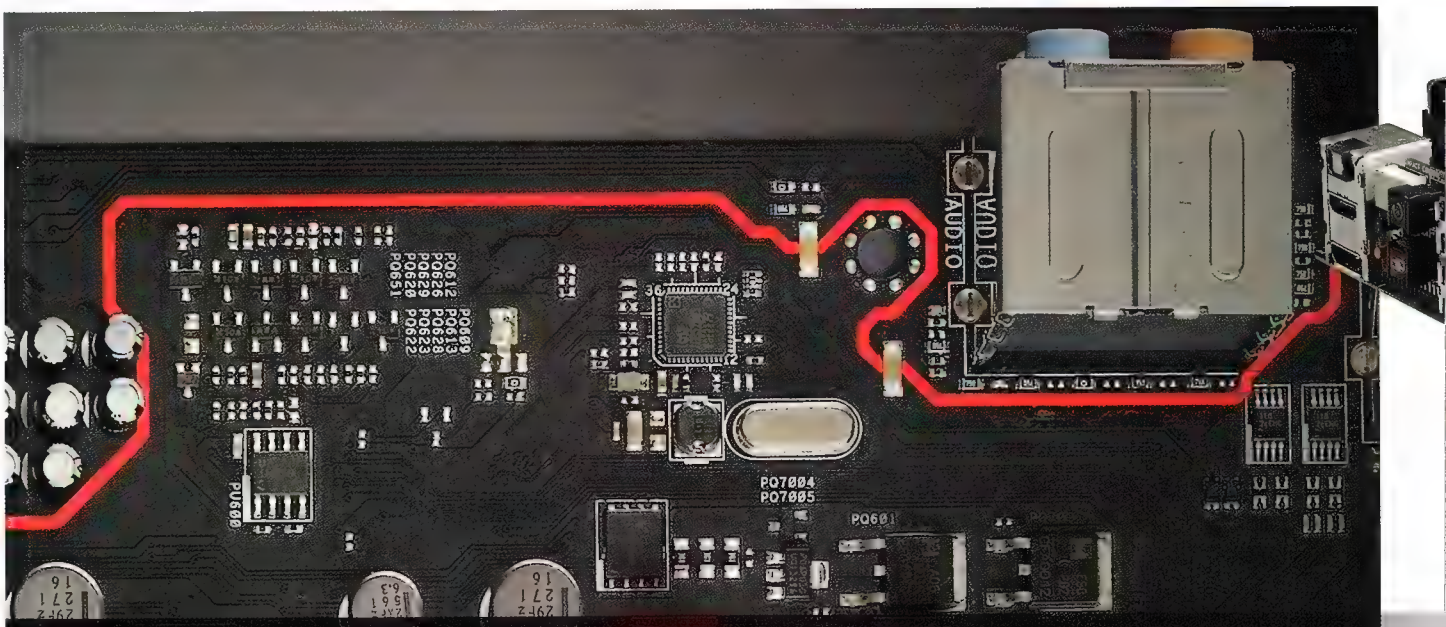
Like the QuickFire, it can only be voodoo magic that allowed Thermaltake to cram a full-sized extended key set (home and numeric key banks included) into such a small form-factor without shrinkifying the key spacing; even my banana-sized fingers had no trouble comfortably hammering out language or deftly manoeuvring between critical gaming keys. Objectively, the Poseidon's Blue-switches are amazing and worked as absolutely intended; up, down, and up, with tactile resistance (and a nice textured feel) the whole way. Subjectively the heavier resistance they provide results in an intense workout for the hands and the closest modern keyboards can get to pounding hammers onto anvils.

Rounding out the Poseidon's modest features is the now ubiquitous Windows lock-out key, four stages of backlighting, 6-8 key N-key rollover and multimedia controls integrated into the top row of F keys. While there's no USB passthrough or headphone/mic ports built into the board, you'll be pressed to find something that capable for this asking price. We just wish it also came in a Cherry Red version. ■ Troy Coleman

Verdict

A very capable small form-factor Cherry Blue mechanical keyboard with a limited, but gaming centric, array of features.

ASUS



ADVERTISING FEATURE

GET THE ULTIMATE IN NETWORK CONTROL

ASUS ROG offers you the ability to tweak, boost and control your bandwidth with its exclusive GameFirst II function.

No matter if you are a gamer looking for the lowest ping, or just want to optimise your network traffic to ensure your YouTube videos always stream smoothly, network management software is essential. Combined with ASUS ROG motherboards, GameFirst II is the latest update to the excellent network control program that can improve everything from gaming and surfing the net to downloading files.

MINIMISE CPU LOAD

GameFirst II is available on select ASUS ROG motherboards, using the Intel Gigabit Ethernet chipset to give maximum network performance. Intel chipsets are well known for their low CPU utilisation, which ensures you have as many CPU cycles as possible for other tasks. For gamers striving for the highest frame rate, this is a must have feature. Other brands and some ASUS motherboards are not supported, so if you are upgrading make sure you get one of the ASUS models from our list.

GAMEFIRST II

With a compatible motherboard, getting GameFirst II up and running is as simple as downloading the software from ASUS and installing it. GameFirst II defaults to EZ Mode – designed to make network control simple and accessible for beginners, while still giving access to powerful setup options. The GUI is straightforward and key features can be accessed in just a few clicks. The GameFirst II network optimiser then optimises the network setup to ensure the best performance based on your needs.

For users that want more in depth control, GameFirst II has an advanced mode. This lets you adjust all the network shaping features individually and get precision control over your data. You can even order your installed programs by network priority to ensure key software always has the bandwidth it needs.

GameFirst II is not just a passive network setup utility – when you first run the software it actively calibrates your network performance and ping times using an online server. The server analyses your specific networking environment so the GameFirst II can automatically adjust for best throughput and performance.

PRIORITIES

In EZ Mode, GameFirst II has four priorities that can be set on the fly with the click of a button. It also has two separate modes – the first gives the best possible ping time at the expense of slightly reduced bandwidth and the second that maximises bandwidth at the expense of a slightly increased ping time.

GAMING

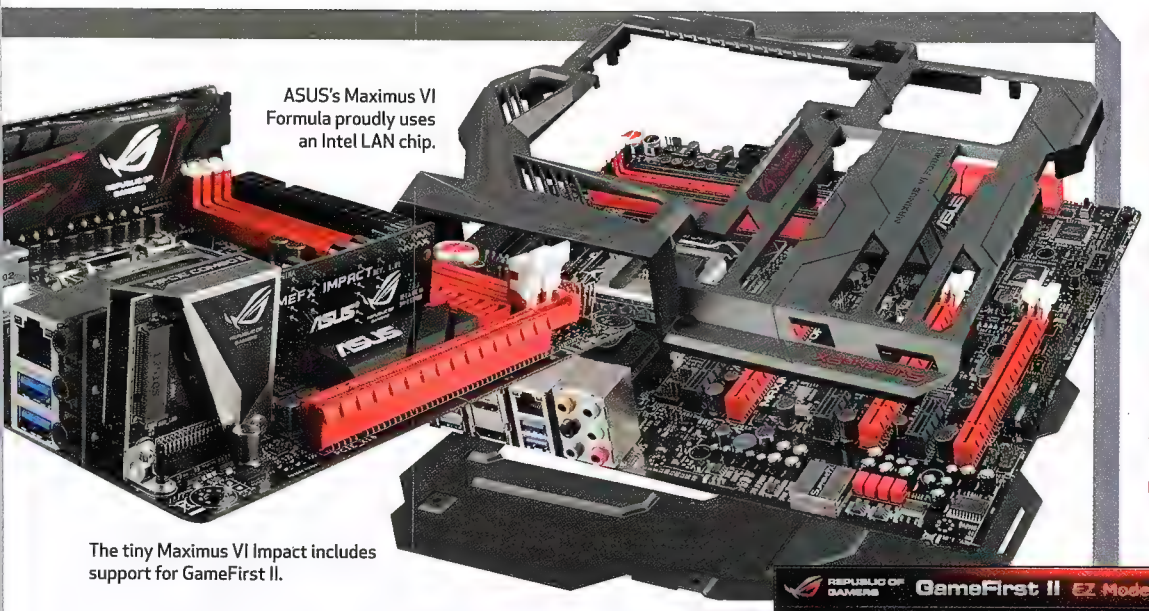
For most online gaming, having a low ping time is all important. In gaming mode, GameFirst II makes ping time all important, and manages bandwidth to ensure your ping is the lowest possible.

VOICE OVER IP

Video calls with programs such as Skype can be a frustrating experience if you are experiencing any lag or bandwidth restriction. The VoIP setting ensures that your communications have top priority and will receive the bandwidth needed, even if another program is trying to access the internet in the background.

MEDIA STREAMING

Watching the YouTube load bar creep along as your video stutters can be maddening, especially if Windows is updating in the background. The media streaming mode intelligently monitors your network traffic and gives priority to media.



ASUS's Maximus VI Formula proudly uses an Intel LAN chip.

The tiny Maximus VI Impact includes support for GameFirst II.

AVAILABILITY

GAMEFIRST II SUPPORTED MODELS:

- RAMPAGE IV BLACK EDITION
- MAXIMUS VI FORMULA
- MAXIMUS VI IMPACT
- VMAXIMUS VI GENE
- MAXIMUS VI HERO
- CROSSHAIR V FORMULA-Z

ROG 802.11AC WI-FI MODULES:

- MAXIMUS VI EXTREME (mPCIE COMBO II)
- MAXIMUS VI FORMULA (mPCIE COMBO II)
- MAXIMUS VI IMPACT (mPCIE COMBO II)
- RAMPAGE IV BLACK EDITION (mPCIE)

TRANSFER SPEED AND CPU USE: INTEL VS KILLER LAN

	INTEL LAN		KILLER E220X	
	SPEED	CPU UTILIZATION	SPEED	CPU UTILIZATION
DOWNLOAD	907.81Mbps	1.75%	905.048Mbps	11.12%
UPLOAD	839.677Mbps	0.80%	807.048Mbps	6.30%

WORLD OF WARCRAFT: PING TESTING

REGION	WITHOUT GAMEFIRST II	WITH GAMEFIRST II
HOME	100ms	12ms
WORLD	103ms	13ms

TESTS WERE CARRIED OUT USING A 10MBPS INTERNET CONNECTION WHILE SIMULTANEOUSLY PERFORMING A NAS TRANSFER, BITTORRENT DOWNLOAD AND STREAMING HD MEDIA. DESPITE EXTREME NETWORK CONGESTION, THE GAMEFIRST II ENSURES THAT PRIORITY IS GIVEN TO MAINTAINING A LOW PING.

GameFirst II lets you adjust network priority on the fly.

FILE SHARING

Everyone knows the pain of firing up their favourite game only to find it needs an update before you can play or watching your Dropbox backup creep along. The File Sharing mode optimises your network to ensure any downloads or uploads get finished as quickly as possible.

MONITORING

GameFirst II monitors your network in real time, but it doesn't just keep that information to itself. The network performance information is displayed so you can see exactly how well your latest network tweaks are performing, and adjust them as needed. The tool also lets you examine the current priority of each application using network bandwidth to make adjustments even easier.

MULTIPLE USERS

GameFirst II is designed to optimise a single PC, but it can also be used on a LAN with other computers. The catch is that they all need to have the GameFirst II software installed and compatible motherboards. If there are machines on the network without GameFirst II, there is an option in the software to still ensure optimal results. For gaming, the biggest concern on a network with multiple PCs will be making sure ping times are kept low even if some users are using high bandwidth programs. With a multi user setup, GameFirst II can maintain low pings for all computers, as well as avoid packet loss, block IPs, operate a firewall and automatically maximise internet throughput.

ALL THINGS WIRELESS

While GameFirst II is designed to maximise LAN performance, wireless connection speed is also important. To optimise Wi-Fi speeds a range of high end ASUS Republic of Gamers motherboards include the Broadcom 94352HMB AC1200 Wi-Fi module. Built on a mPCIe Combo II card, the module features dual band 2.4GHz / 5GHz 802.11ac Wi-Fi as well as Bluetooth 4.0. It maximises your network connection when unplugged from your LAN. It also has a Next Generation Form Factor (NGFF) expansion slot. While you won't be using it right away, this port is a new standard that aims to replace mSATA and mPCIe and give higher SSD speeds. So in the future, you can plug in next generation SSD into your current system.

The Wi-Fi module also lets you use a nifty ASUS app called WiFi GO! Remote. Compatible with both Android and iOS, WiFi GO lets you tap into your PC via your smartphone.

You can remote control your computer using touch or motion, stream DNLA media, transfer files and view your desktop. It also lets you use your smartphone has a keyboard and mouse for your PC.

THE END RESULT

An ASUS GameFirst II motherboard and Wi-Fi module lets you get the maximum performance possible from your network on both wired and wireless. Whether you're a beginner or advanced user, GameFirst II intelligently optimises your bandwidth while letting you hand tweak performance. Whether you are a gamer, use VoIP, stream media or just download a lot of files, GameFirst II ensures you have the best experience possible. For Wi-Fi users, the ASUS module ensures the best possible connection, future upgradability as well as the ability to remotely control your PC from your smartphone.

ASUS®

software

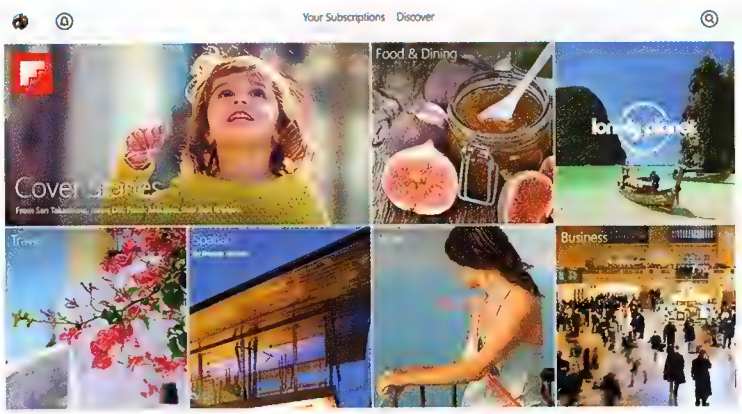
» APPS FOR ALL THE PLATFORMS BY PETER DOCKRILL & CRAIG GRANNELL

Windows SOFTWARE

Flipboard

Flipping on your desktop, finally - but at what cost?

FREE | FLIPBOARD | TINYURL.COM/MOXM8PV



The arrival of Flipboard on Windows 8.1 represents somewhat of a milestone for the popular news-reading/magazine-making app, in that it's the first time Flipboard has touched down on a desktop – as opposed to exclusively mobile – platform. Of course, Windows 8 is really in a unique, hybrid position compared to others OSs, in that it attempts to cater to both touch/tablet interfaces and keyboard/mouse simultaneously (with varying degrees of success). But in any case, Flipboard's never shown up for Windows (7 or previous), nor Mac or Linux, so it's a significant coup for Microsoft's latest offering.

So how does Flipboard feel in Windows 8.1? Well, it's a bit of a mixed bag, unfortunately. The app certainly looks the goods, with its trademark pseudo-magazine layout filling the display nicely, but alas defaulting to Windows' Modern font and stylistic touch points in place of the usual Flipboard hallmarks makes the app feel less like a Flipboard 'magazine' and more like any other generic Windows 8 news app. All of Flipboard's regular functionality is present, however – including the much-ballyhooed make-a-mag feature – plus you can pin sections as live tiles, and the app also supports splitting the screen.

Bizarrely, though, the default page-flipping gesture on a trackpad is a downwards swipe (as opposed to a right-to-left gesture), much like Flipboard's vertically configured smartphone apps (although it makes no sense here, when the animation and display are both horizontal). This, along with a few other interface oddities for Windows 8.1 users utilising a traditional desktop setup (ie. keyboard and mouse, who will be the vast majority), mean Flipboard's not fully realised yet. Hopefully the development team can iron some of the wrinkles out in the near future.

3D Builder

FREE | MICROSOFT | TINYURL.COM/KTTL5WS

3D printing is still a decidedly niche hobby, but with increasing software support — like Microsoft's just-released 3D Builder effort here — and falling prices on consumer devices like MakerBot's well-regarded lineup, we're approaching the point where the tech could soon become a mainstream plaything. 3D Builder is fairly rudimentary as far as the amount of control you've got over 3D items goes (it's not a CAD program, which the screenshots almost suggest), but it's an interesting introduction to 3D spatial thinking and comes with a sizeable library of objects you can scale, angle, duplicate and print (if you're lucky enough to have a 3D printer, that is).

Star Wars: Tiny Death Star

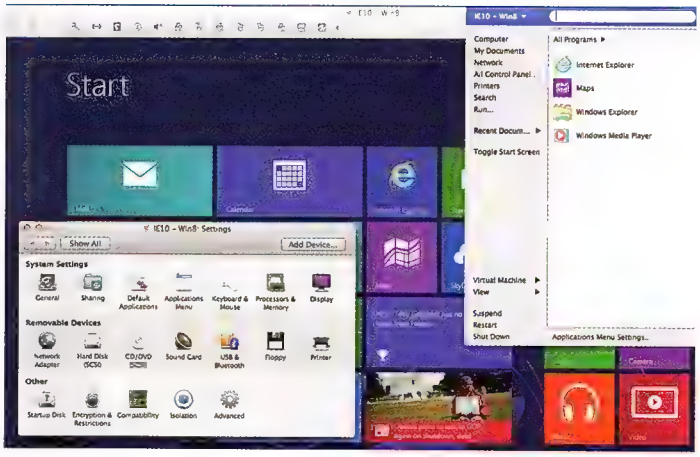
FREE | LUCASARTS | TINYURL.COM/MAJCW23

NimbleBit's *Tiny Tower* series has been around for a while now, spawning spin-offs in *Pocket Planes* and *Pocket Trains*, but *Star Wars: Tiny Death Star* represents the first time the developers have spun another brand into their mini-management mania. If you've ever played a *Tiny Tower* title you'll know what to expect: you wait for little 'bitizens' to turn up, find them housing and assign them to jobs, then build new dwellings and businesses as your mini-empire expands. This time there's a twist: namely, you're Darth Vader, building up the Death Star at the penny-pinching behest of the Emperor. The result is tremendous fun for those who enjoy the *Star Wars* universe, with in-jokes ahoy, although the relatively shallow style of gameplay (and enforced wait times vs IAP tempters) probably won't be for everyone.

VMware Fusion 6

Another update to a great app, but it feels too much like Groundhog Day.

$62.95 | VMWARE | WWW.VMWARE.COM/AU



Hot on the heels of Parallels Desktop comes VMware's latest Fusion update. Like its rival, Fusion 6 enables you to run a wide range of operating systems as virtual machines on your Mac, from the latest flavour of Windows through to obscure Linux distributions. Also like Parallels, Fusion's latest update is slight.

The majority of changes are as you'd expect: Fusion 6 is a bit faster than Fusion 5, and it fully supports OS X Mavericks and Windows 8.1. Improvements cater for recent Macs, including support for the latest Haswell Macs, and there's font optimisation for Retina displays. OS X Dictation is supported along with AirPlay, and Windows Store apps can be pinned to the Dock. There's the means to create immensely powerful VMs, making the most of up to 16 CPUs (up from 8) and 64GB of RAM (up from 8). A Professional edition of Fusion ($135.95) adds enterprise-oriented features, such as restricted and expiring VMs and network functions.

On pitching Fusion against Parallels Desktop on our test Macs, blows were traded until the two were left staring at each other, bloodied and equal on points. Fusion was faster at suspending VMs, but Parallels woke them more quickly; we loved how Fusion's menu-bar extra enabled easy access to apps and settings, but Parallels' VM install screen provides useful links to OS installs; regarding customisation and price, Fusion edges ahead, but Parallels is a touch friendlier (albeit more intrusive in terms of Dock clutter), and during testing was a smidge more reliable.

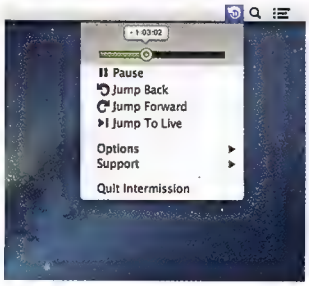
Where both apps are identical is in being excellent, yet offering little to tempt switchers and anyone upgrading from an earlier version, unless they find it no longer works with their set-up.

Intermission

US$15 | ROGUE AMOEBA | ROGUEAMOEBA.COM

Intermission is a Mac app that writes audio streams to a buffer that can be paused and continued like live TV on a PVR. The simple controls are accessed through a menu bar extra or user-definable system-wide shortcuts. Along with a pause/play toggle, you have access to jump forwards/backwards (set to ten seconds, but this can be easily adjusted) and the means to jump to the live audio stream.

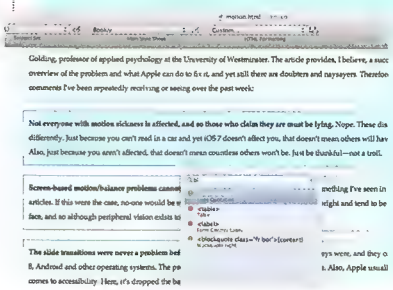
We thought Intermission would be useful for skipping adverts, but doing so requires letting a big buffer build up. Instead, we found the app better for going back and checking a name or detail on a radio broadcast or podcast. But, exploring your buffer — which can be three hours in length — can be fiddly due to the tiny scrubbing bar and lack of 1.5× or greater playback speed. There's also no audio export option.

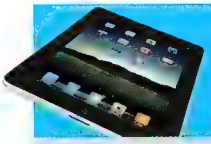


TypeMetal

$31.99 | COHERENCE LABS | COHERENCELABS.COM

Text editors and word processors provide tools for defining lists and headings. Online, such things are even more important, with mark-up definitions being interpreted by web browsers, to correctly display web pages. With more content shifting to web, it's useful to be familiar with HTML, or work with systems that output mark-up. TypeMetal is an editor that falls between WYSIWYG editors and minimal writing tools, letting you create structured text-oriented documents fit for the web. Much of TypeMetal's value lies in its ability to appeal to a range of content-creators. Beginners can write as they would in a text editor, using the Structure menu to format content. Some options are perhaps a bit opaque for HTML newcomers, but it's easy to see <h1> through to <h6> denotes headings. For those already immersed in HTML, TypeMetal reveals depth, given its minimal appearance. A path bar shows where you are within the document hierarchy, and keyboard shortcuts provide swift navigation. You can highlight block elements, define custom CSS and HTML snippets (including those that 'lock out' elements if your CMS doesn't play nicely with them). There's a weak spot regarding code previewing (a sluggish floating 'loupe', where an optional split view might have worked better), but other niggles disappeared with practice.



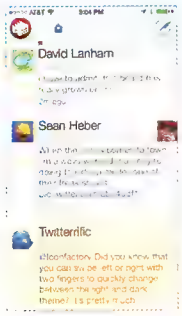


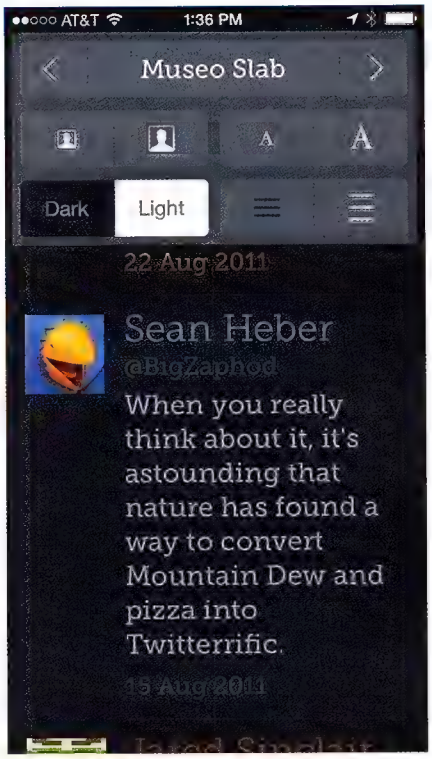
App Store » iOS APPS

Twitterrific 5 for Twitter

The early bird catches the worm

$2.99 | THE ICONFACTORY | TINYURL.COM/PXL9QWJ





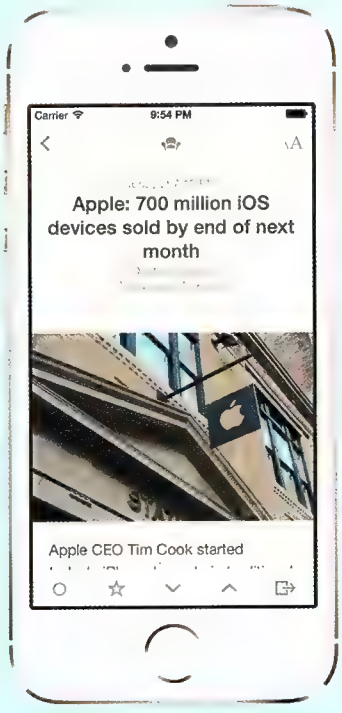
One big result of the design changes in iOS 7 is suddenly the playing field is level again for app developers. With a new design language to get into, all the old favourites lose their advantage. Take Tweetbot, probably the most popular third-party Twitter app – until recently. Now Twitterrific has emerged victorious as the new favourite.

It's not a new app, and its developer actually coined the term 'tweet'. But it was one of the first to embrace Apple's new direction, and was even rapidly updated to support the 64-bit processor of the iPhone 5s. Twitterrific 5 is clean to look at, bringing the content of Twitter to the fore, complementing the strongest element of iOS 7's philosophy.

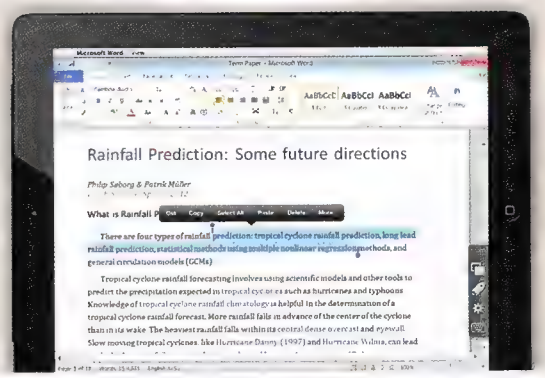
But it goes beyond just being a good companion to the new OS. It has the powerful hidden features for committed users that we like from this kind of app, giving you room to grow and get more involved in Twitter. You can configure how it looks, personalising it a little more for you, and there's a great unified timeline, adding all of your mentions (even from those you don't follow) into your main Twitter timeline.

Reeder 2

$5.49 | SILVIO RIZZI | TINYURL.COM/MMXA7SB



After the death of Google Reader, we're now seeing the return of many RSS apps, including Reeder. This Universal iOS app (Mac version to follow) offers support for Feedly and Feed Wrangler, among others, and you can set up new accounts and add feeds within the app. Reeder itself is much like it was before in terms of features, letting you sync feeds, organise them, star favourites and read in a clean view. It works nicely, but the interface isn't perfect. It's been simplified for iOS 7, and then pared back more. It's not obvious what some icons mean, the toggle switches are unclear, and it can get confused between dragging and using gesture controls. You can get past most of these issues, though. Reeder is a great way to catch up with favourite web sites, and to share articles with other apps thanks to its vast social options.



Parallels Access

FREE (WITH SUBSCRIPTION) | PARALLELS INC | TINYURL.COM/LGCSZ4Y

Parallels' new Access app is a remote desktop client, letting you control your Mac or Windows PC from your iPad, but with some changes to make it more touch-friendly. Your desktop apps are shown in an iOS-like grid, and there's a smart app switcher. There's also a clever mouse tool that uses snapping and a magnifying glass to make it easier to make fiddly selections, but perhaps the biggest change is that text can be edited with iOS text controls instead of trying to use the PC's cursor. However, Access can't make full Photoshop usable on your iPad, for instance. The magnifying tool makes it bearable to make tweaks, and the text selection tools are handy, but we wouldn't want to write in Office on our iPad. Parallels Access was good overall with stream reliability. But the $50+ cost for the year's subscription is high.

Snapseed

Forget those instant filter packs; conjour your own hues instead

FREE | NIK SOFTWARE | TINYURL.COM/B8A3XA9

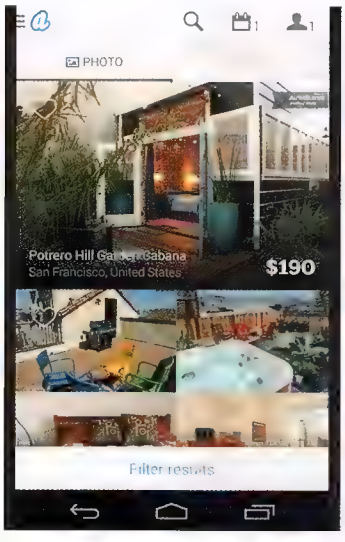
Photo-editing apps are a dime a dozen these days, and compared to the kind of free photo-editing software that was available even five years ago, they're all extremely accomplished and powerful. Amongst the dozens of quality titles on offer, Snapseed stands out for its extremely easy-to-use interface.

While there's still a bit of a learning curve, Snapseed's up-down swiping (to select specific tools and image attributes) mixed with left-right swiping (to select degree of intensity) makes it a cinch to edit your images quickly. With simple, automatic and artistic adjustments literally only a couple of taps away – but still highly malleable due to the degree of manual control you're given – Snapseed is practically guaranteed to transform (or redeem) your photos faster than any other image editor.

CyanogenMod Installer

FREE | CYNGN | TINYURL.COM/KFNRZBZ

If you ever needed proof of Google's laissez-faire attitude to allowing practically anything on Google Play — as opposed to Apple's far more restrictive (but slickly curated) 'walled garden' approach with the App Store — it's this: CyanogenMod Installer. In short, this app is designed to let you install a whole new Android operating system on your phone — CyanogenMod OS, currently based on Android 4.3. It won't do the whole job itself (it's a helper app designed to be used in conjunction with a PC installer process), but it's still pretty amazing that this once niche ROM-installing community now has an official tailored CyanogenMod app for download. If you're curious, please do your research first. CyanogenMod Installer is designed to be easy to use, but modifying your handset in this way has its fair share of pitfalls and will almost certainly void your warranty to boot.



Airbnb

FREE | AIRBNB | TINYURL.COM/KVOLRMJ

Like an eBay for temporary accommodation, Airbnb has transformed the way people organise their holidays and getaways (and even work trips). Rather than paying commercial rates to stay in yet another indistinct and colourless hotel room when you're out of town, the service lets travellers organise and hire accommodation in the spare rooms, flats and sub-lets of Airbnb users around the world. The community is vast, with 450,000+ listings in more than 34,000 cities internationally, and the official Airbnb app lets users discover and book places from their mobile, while enabling hosts to manage their listings. So travellers: why not see a more genuine and local side of life on your next sojourn? And hosts! Don't forget to declare all that extra income you're earning on the side to the taxman, right?

Plague Inc.

FREE WITH IAP | MINICLIP.COM | TINYURL.COM/POYFF3H

Pop culture proves many things, one of which is that people are obsessed with the prospect of annihilation by super-bug. Whether it's The Stand, Contagion or 28 Days Later, folks just love the idea of a highly communicable ultra-virus wiping out humanity as ickily as possible. Plague Inc. — the hit iOS strategy game developed by Ndemic Creations, now faithfully ported to Android — gives you the chance to be the bug: your job is to devise the most poisonous pathogen possible, then help it spread. The latest updates — and this game is already famous for getting a lot of ongoing love from its developers, ensuring there's a ton of content on offer — includes speed run challenges to see how quickly you can kill the world. Really, what's not to like?

Windows Store » WIN PHONE 8

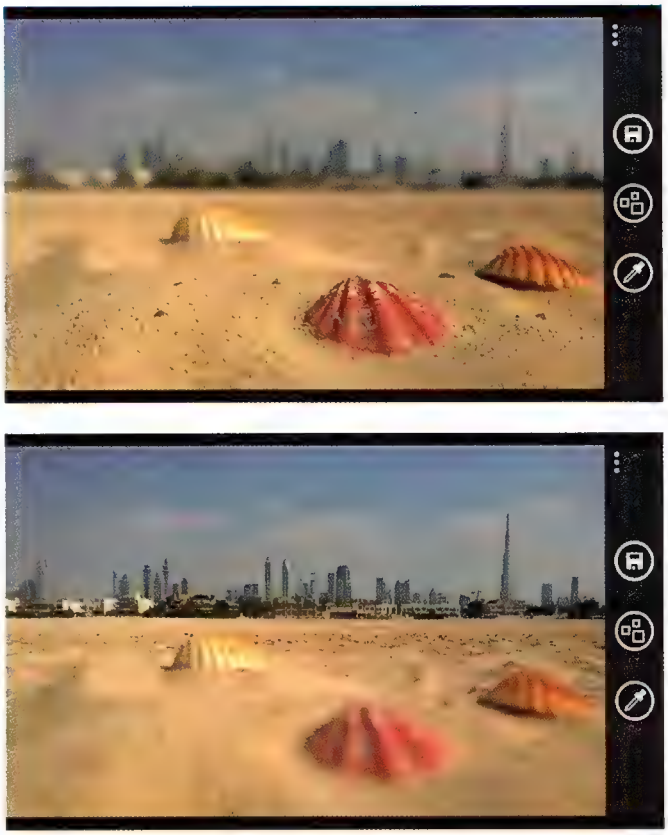
Nokia Refocus

Shoot first, ask questions later.

FREE | NOKIA | TINYURL.COM/PLP5XEA

Ever heard of Lytro? It's an extremely innovative camera company that invented a whole new way of taking photographs that you can focus *after* they've been shot. Yep, it sounds crazy, but it's true. The only downside: Lytro cameras are kind of pricey.

Luckily for smartphone users, app developers have taken the idea and run with it, the latest being Nokia Refocus, which works with any Nokia 'Pureview' Windows Phones. Unlike the Lytro - which performs its magic via hardware — apps like Refocus fake the effect in software, taking several shots at different focal points in quick succession, then subtly readjusting the image so wherever you tap, it 'focuses'. This method means you'll need to keep your device very steady as you take your shot, but it's certainly a nifty parlour trick.



Vine

FREE | VINE LABS | TINYURL.COM/OVHAPVQ

In the space of the past year, Windows Phone has truly solidified its position as the #3 smartphone player in the market, capitalising on rival BlackBerry's ongoing misfortunes. And with WP's growth, hopefully we'll see a few more of iOS and Android's draw-card apps make their way to the platform, so users won't have to continue relying on hit-and-miss third-party clients. One such recent official debutante to the Windows Phone Store is Vine, Twitter's hugely successful micro-video app. Vine lets you shoot and share looping six-second short films. It sounds a little insubstantial put like that — and it does offer a fairly minimal feature set — but give it a try. It's fun, breezy and social — and you just might surprise yourself, creativity-wise.

Asphalt 8: Airborne

$0.99 | GAMELOFT | TINYURL.COM/POD539L

Ok, we'll admit we've been a little harsh on Gameloft in the past (we had our reasons, mind you), but let us be the first to concede that the latest entry in the venerable *Asphalt* series is a veritable cracker of an arcade racer. Don't expect (remotely) realistic physics or car behaviour; this is no *Gran-Turismo*-esque exercise in art imitating life. Instead you'll be drifting around corners, jumping between tracks, smashing up rivals and chasing nitro refills. You can even steer your car in the air Mario-Kart-style (huh?) and perform airborne stunts, yet amidst all the rest of the petrol-fume lunacy it seems to make perfect sense. In short, this is car racing for the *Fast and the Furious* crowd: completely ridiculous but also a reckless good time. Free to try.

Awesome Lock

$1.49 | TWISTED LAB | TINYURL.COM/KMG22GM

Of the current crop of mobile OSs, Windows Phone enjoys the most tasteful-looking lock screens — all sparse text and lush photo backdrops. But if you'd like a little more context and utility to go along with your humble wallpaper, try Awesome Lock on for size. On top of the standard lock display, Awesome Lock overlays weather details for your current location (including tomorrow's forecast), plus stock information and news headlines. The app comes pre-loaded with various mainstream news sites for numerous countries, but you can also customise your own sources via RSS — although disappointingly there seems to be no way to go beyond the RSS summary and access the whole story. Still, for very little cost, Awesome Lock certainly livens up your otherwise static lock screen. Free trial available.

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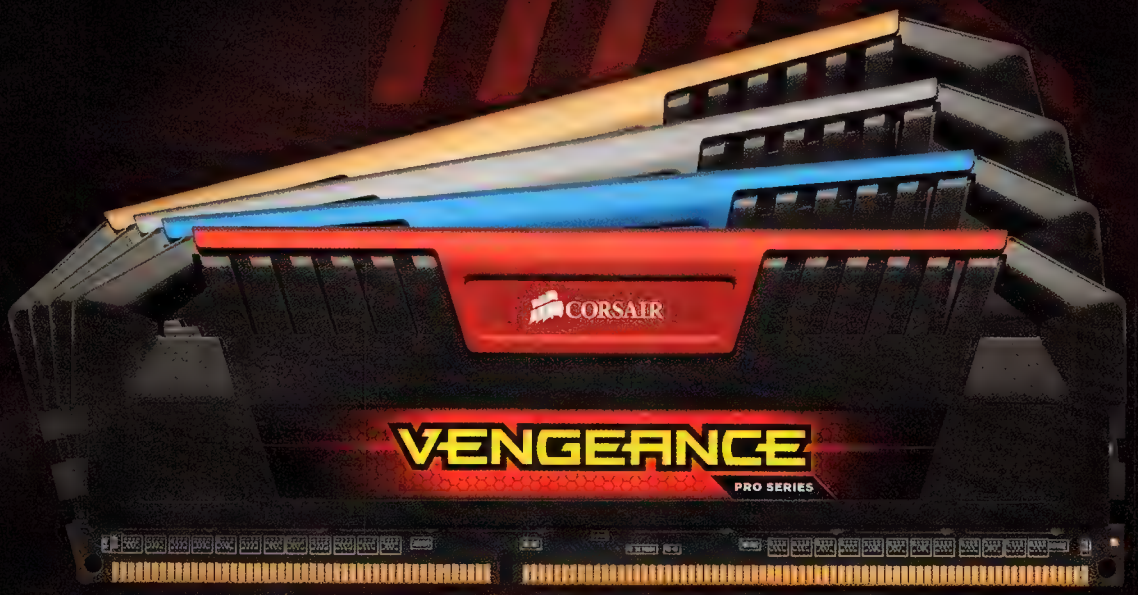

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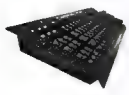

GAMING KEYBOARDS

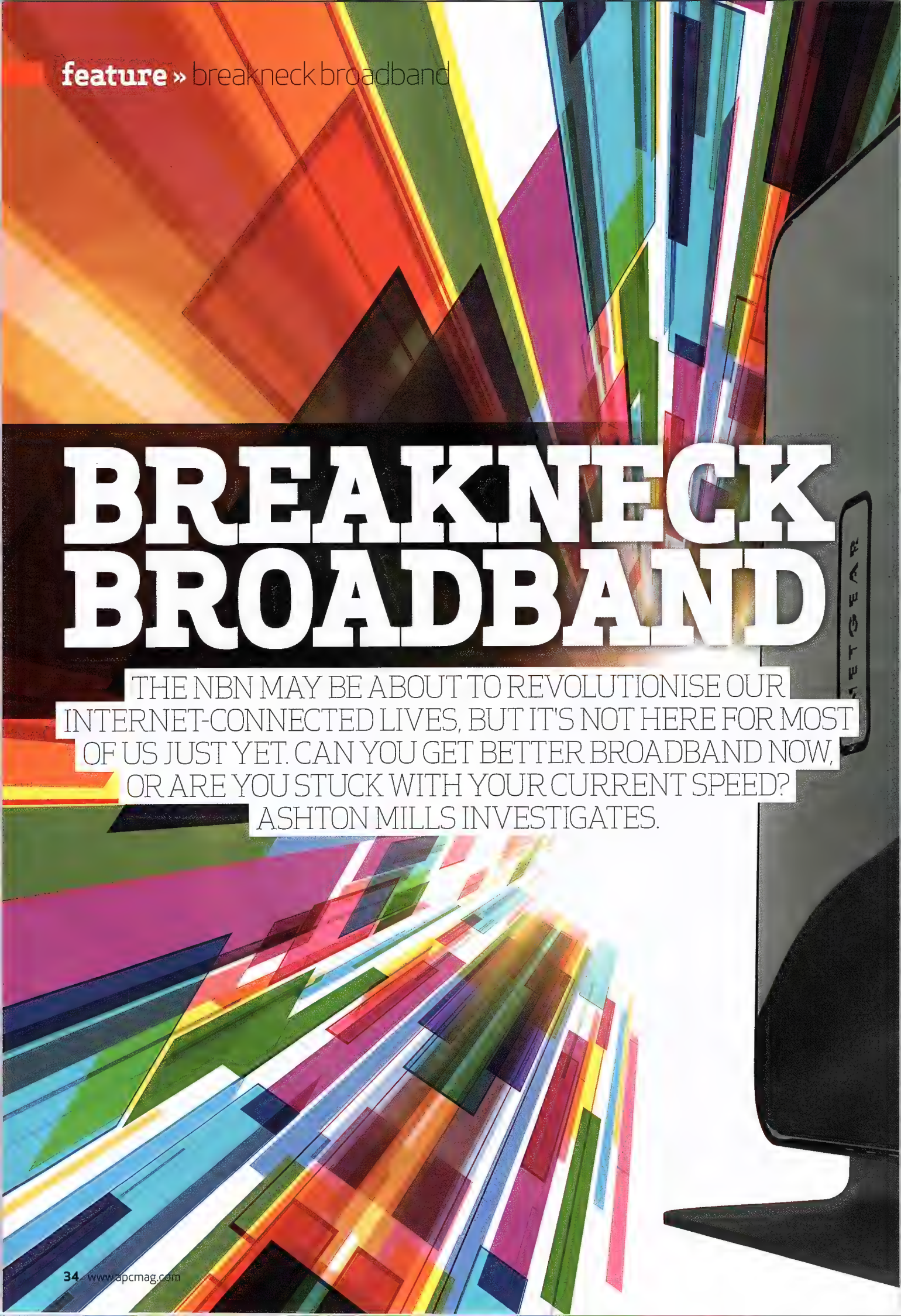
CPU COOLERS

MICE

HEADSETS

BREAKNECK BROADBAND

THE NBN MAY BE ABOUT TO REVOLUTIONISE OUR INTERNET-CONNECTED LIVES, BUT IT'S NOT HERE FOR MOST OF US JUST YET. CAN YOU GET BETTER BROADBAND NOW, OR ARE YOU STUCK WITH YOUR CURRENT SPEED? ASHTON MILLS INVESTIGATES.



With all the bad press the NBN has had over the last few years – everything from cost blow-outs and deployment delays to asbestos scares and now a change of government and the very design of the infrastructure itself with fibre-to-the-node – it seems like our promised future of super-fast broadband for the whole of Australia is has become an increasingly comical tax-payer funded joke.

But then, that's bureaucracy for you.

Eventually, of course, we can all expect to gain access to the NBN in some form by its current estimated completion date of 2019. Which is an awfully long way away for many of us.

But that doesn't mean you can't gain access to faster broadband now. Despite the aging infrastructure of copper phone lines, also known as copper twisted-pair, ADSL is surprisingly robust. And your standard ADSL plan isn't the only option available. Of course, there's always a catch: and here it comes down to how much you're willing to spend.

But first, a little background.

UNDERSTANDING BROADBAND

Back in the day – that is, when the dinosaurs among us remember what BAUD stands for (googlefu: **www.wikipedia.org/wiki/Baud**) – dial-up modems continued to develop until they got to insane crazy-fast speeds like 54Kbps. Insane, right? Who needs more than that!

To put this in perspective, the theoretical maximum of modern-day ADSL2+ is 24,000Kbps – a little over 400-times faster. Even at half this speed – and what you're likely to see for the majority of connections – it's still an incredible 200 times faster than ye old dial-up. And all this, still, via the aging copper infrastructure of our telecommunications system.

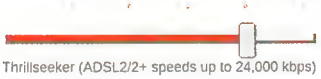
To be sure ADSL is a remarkable achievement, utilising hundreds of frequency channels and intelligent line quality compensation to deliver speeds far superior to the original dial-up modem over the same copper wire. The trade-off is a limitation in distance, and the requirement of DSLAMs (digital subscriber line access multiplexer) to manage connections at an exchange.

But it, too, is becoming limited for what will be the demands of an increasingly bandwidth hungry society in the future. Hence the NBN, a timely development that – despite the naysayers – really will position Australia well for the future.

But until then ADSL and similar technologies will be with us for many years, and may even still play a role once the NBN is complete.

TYPES OF BROADBAND

The term broadband, so much as it is used with regards to internet access, covers a range of technologies based on ITU (international telecommunication union) standards. While ADSL is synonymous with broadband, it's not the only broadband technology employed by ISPs. ADSL sees the greatest use among residential customers because its asymmetrical nature and ability to go long distances make it ideal. But ISPs also offer business-level services that can employ technologies faster than



Thrillseeker (ADSL2/2+ speeds up to 24,000 kbps)

Profile	Speed	Description
Safe	ADSL1 Speed up to 8,000 kbps	If you have an older modem it may not support ADSL2/2+ speeds in excess of 8,000kbps. So play it safe.
Controlled	ADSL2/2+ Speeds up to 24,000 kb ps (FAST)	If you want to push the speed up a little but keep a stable connection. You may need this if you have poor line quality.
Standard	ADSL2/2+ Speeds up to 24,000 kbps (FASTER)	This is our default setting that suits most users. It's still really fast, but usually gives good connection stability.
Thrillseeker	ADSL2/2+ Speeds up to 24,000 kbps (FASTEST)	If you want to push the broadband speed limit. You'll definitely get the fastest speeds possible on your line. But you may hit the occasional speed bump or two.
Gamer	ADSL2/2+ Speeds up to 24,000 kbps (UNINTERRUPTED)	Well suited for time sensitive, interactive applications such as gaming, this selection is designed to provide the quickest connection response rather than a faster download speed.

Please note:

** Changes may take up to 3 hours to take effect. During this time your connection will be briefly interrupted, so p time convenient to make this change.

Click submit to change your settings and optimise your connection.

The biggest factors effecting connection speed are line quality and distance from the exchange. Some ISPs however offer profiles to tune the connection to your preference.

ADSL. However, these are frequently expensive not just because they're aimed at business, but because they can require the installation of new connections to a premises, as well as the required technology at exchanges and on the ISPs network. Still, there are frequently different levels of service on offer utilising everything from ADSL through to SHDSL and fibre, all at different price points.

In Australia the popular standards offered as services are covered below, though it's worth noting that these standards are separate from the underlying carrier medium. For example, VDSL can be delivered over twisted copper-pair, or coaxial cable. For this reason, especially with business-oriented plans, ISPs will sell a product based on what it's promised to do, regardless of the underlying standard that it uses. It's important to keep this in mind however as anything above ADSL will usually require installation of extra equipment to hook up a location (the exception can be where cable is already laid, such as with Foxtel services).

Obviously if you're a small or medium business looking to upgrade your service, these costs are part of doing business. There's nothing stopping you getting a business-level service installed at home however, assuming you have the will and deep enough pockets.

ADSL

ADSL (Asymmetrical Digital Subscriber Line) covers various implementations that range in speed from 8Mbps downstream and 1Mbps upstream to 24Mbps downstream and 1Mb upstream. The asymmetrical title comes from the difference between downstream and upstream speeds, where priority is given for downstream if the available bandwidth over the twisted-copper pair phone lines that make up our telecommunications infrastructure today. While ADSL2+ is the fastest, you may only have ADSL or ADSL2 available depending on your location.

Additionally, upstream speeds of up to 3.3Mbps are possible using the Annex M version of ADSL2+, which emphasises available frequencies for upstream at the expense of downstream – that is you get faster uploads, but slower downloads. However, while ADSL can typically work well up to 5km from the exchange, Annex M effectiveness trails off sharply above 2km. Some ISPs offer Annex M only on business plans, while others may provide it as an option for standard consumer plans. In both cases it's usually a free addon.

You might be wondering why have asymmetrical speeds at all, surely uploads are just as important? In practice, however, they're not – consumer use of

GET BETTER ADSL SPEED NOW

- Go for a naked DSL plan with your ISP. This will give you more of the line's bandwidth to use for data.
- Failing this, if you can live without it, unplug your land-line phone and remove the ADSL line filter. You will get a boost to your connection rate. If you still need to do voice calls, you'll need to sign up for VoIP. Naked DSL plans often bundle in VoIP for you.
- Make the cable from the phone port to the modem as short as possible. If you use a long phone extension cable at the moment consider moving the modem closer to the port, using a shorter cable, and using Ethernet or wireless to extend access to the modem for your network and PCs. While it may seem such a short distance for this cable given the total distance to the exchange, phone cables are not shielded. Additionally, keep the cable and modem away from other powered equipment.
- Use the 'first port' in the house, that is the one closest to the line's connection to outside. Test the modem on every port to find this.
- Don't use operating system tweaks. There was a time where the TCP/IP stack and internal networking of Windows and Linux could be improved through various tweaks. These days however both operating systems are well-optimised for broadband connections, and automatically adjust to connection quality. Editing network and TCP/IP parameters can have a benefit for servers, but not your average home or office PC.
- If you're experiencing bad line quality try switching to a lower standard in the modem setup – e.g using ADSL over ADSL2+ may provide a faster throughput for bad quality or long distance lines.
- Some ISPs offer options in their account setup to also adjust the connection properties. iiNet for example provides for a 'Controlled' setting that may connect at a slower speed but provide a more stable service, as well as a 'Gamer' setting that trades connection speed for faster response times. Check with your ISP for similar features.

THE BASICS OF ADSL

WHAT YOU NEED TO KNOW.

While the classic 56Kbps modems of the past utilised the same frequencies as voice for the traditional POTS (plain old telephone system) network, ADSL can use these frequencies and a lot more than copper wires can carry. In order to do so however equipment, called a DSLAM (digital subscriber line access multiplexer), must be installed at an exchange to communicate with ADSL modems and utilise the full bandwidth available over twisted-pair.

The bandwidth that twisted-pair is capable of carrying is divided into up to 512 'bins' spanning 28KHz to 2.2MHz. Each bin is effectively a modem, and can be used for downstream, upstream, or management signalling. The number of bins used, and the connection speed you attain, depend on the distance and quality of the line from the exchange – different frequencies travel different distances, and the modem and DSLAM will negotiate which bins can effectively transmit data when the connection is first established, compensating for line noise and attenuation.

ADSL works best less than 4km from an exchange, though ideally and for speeds above 10,000Kbps the distance should be 2km or less.

the internet is heavily weighted to receive data, and with limited bandwidth available over twisted copper pair, it's simply an efficient use of available resources to prioritise downstream. The same is not necessarily true for business, however, which is why there are alternative options that can provide substantially higher upstream throughput (such as SHDSL and VDSL, covered next).

Finally, as a consumer service ADSL is designed to share the line with your typical land-line phone service, which it does through the use of an in-line filter attached between modem and the wall that prevents the modem using frequencies reserved to carry voice. However, less available frequencies means reduced connection speed. Hence most ISPs offer a 'naked' service which removes the land-line and, in turn, allows the ADSL modem to use all available bandwidth for the internet connection. To maintain voice services, VoIP (voice over IP) is provided instead and, combined with the ubiquity of mobile phones today, there seems little need for a land-line service in the average home.

As far as cost goes there's obviously a wealth of plans available, usually based around download caps. For the purposes of comparison to other technologies covered here, an Internode naked DSL plan for example can be had as cheap as $60/month ranging to $110/month with a large 1.2TB data cap.

BONDED DSL

Bonded DSL, as the name implies, bonds together two separate ADSL connections to form one link that is (give or take) directly equivalent in speed to two lines. Unfortunately it's not as simple as just hooking up another modem – a special bonded ADSL modem is required to pair the lines together, in addition to requiring two twisted-pair copper lines at the premises and a second port allocated at the DSLAM. Here the DSLAM and modem split packets between the lines to utilise the bandwidth of both at the same time, which are recombined at each end to appear as a single connection.

> "Combined with the ubiquity of mobile phones today, there seems little need for a land-line in the average home."

The extra costs of the lines, modem, and service plan (you typically pay for the equivalent of two ADSL plans plus a service overhead) means bonded DSL is usually offered as a mid-tier business option, sitting between ADSL2+ and SHDSL services. However, there's technically nothing really stopping residential customers from using bonded DSL.

As for cost, iiNet's bonded DSL service comes in at around $200 a month for two lines with a 250GB cap.

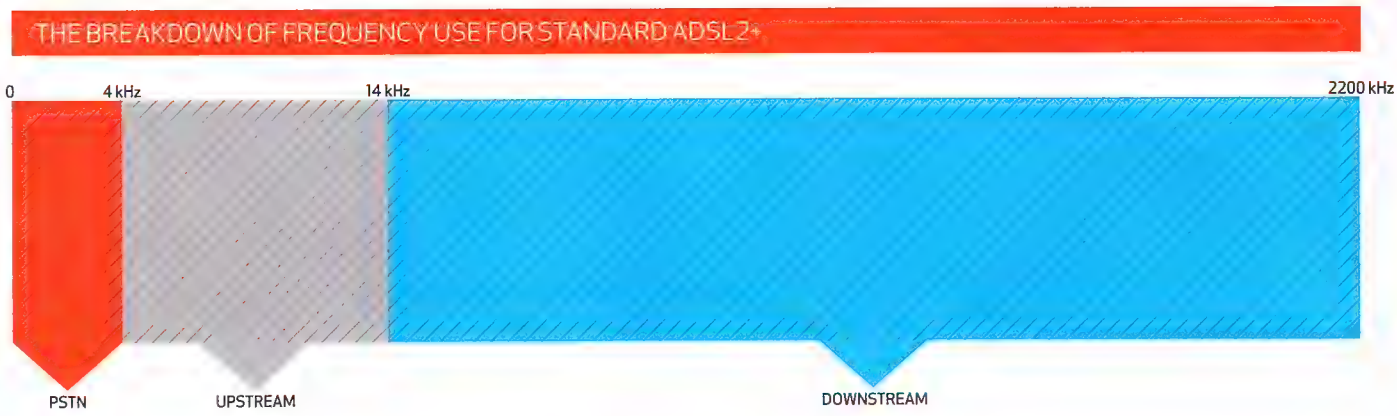
SHDSL

SHDSL (Symmetrical high-speed digital subscriber line) is, as it sounds, similar to ADSL but as the title suggests utilises symmetrical speeds for downstream and upstream. Much like naked DSL it uses the full bandwidth of the copper line and so cannot be used with land-line voice on the same twisted-pair, and similar to bonded ADSL can combine

BROADBAND TECHNOLOGIES OVERVIEW

TECHNOLOGY	TYPE	MAX DOWN-STREAM	MAX UPSTREAM (1)	MAX EFFECTIVE DISTANCE
ADSL	ASYMMETRICAL	8MBIT	1MBIT	5KM
ADSL2	ASYMMETRICAL	12MBIT	1MBIT	5KM
ADSL2+	ASYMMETRICAL	24MBIT	1MBIT	5KM
BONDED DSL	ASYMMETRICAL	48MBIT	2MBIT	5KM
SHDSL	SYMMETRICAL	80MBIT	80MBIT	3KM
VDSL	ASYMM/SYMMETRICAL	100MBIT	50MBIT	2KM
CABLE	ASYMM/SYMMETRICAL	100MBIT	2MBIT	N/A (2)
FIBRE	ASYMM/SYMMETRICAL	100MBIT	40MBIT	N/A (2)
WIRELESS 4G	ASYMMETRICAL	50MBIT	2MBIT	N/A (3)
SATELLITE	ASYMMETRICAL	0.8MBIT	0.1MBIT	N/A

(1) - Note the technology may be capable of more, but ISPs limit speed (2) - No practical limit with respect to typical infrastructure distances (3) - Quality drops off sharply with distance, network load, interference



multiple lines together – but can use as much as eight copper-wire pairs in tandem.

Due to the symmetrical nature for a single line SHDSL download speeds are often slower than ADSL, but uploads speeds are faster. As you combine more lines or opt for a higher speed service, SHDSL leaves ADSL in the dust: speeds up to 80Mbps downstream and up can be had at the top tier.

As with bonded DSL, SHDSL needs specialised modems and support at the exchange. It's also not limited to copper-wire pairs and can be delivered over mediums like fibre, though this is uncommon.

As it's designed to be flexible and meet a given business' need, speeds and plans can vary greatly, typically ranging from a minimum 2Mbps symmetrical up to 40Mbps depending on the level of service being subscribed to. The more recent advance to 80Mbps speeds is not currently offered by all ISPs, and is dependent on (as with all DSL) distance from the exchange. However, SHDSL can combine multiple lines to allow for fast speeds at short distances, or low speeds at longer distances beyond what ADSL can deliver.

Prices can be as little as a few hundred dollars a month for a 2Mbps/2Mbps line, up to thousands of dollars a month for a 10Mbps/10Mbps plan, with costs increasing the further a premise is away from an exchange (regional areas for instance can be quite expensive).

VDSL

VDSL (Very-high-bit-rate digital subscriber line) can provide substantially better speeds over a single-pair twisted copper line than ADSL, typically twice the speed with 55Mbps downstream and 3.3Mbps upstream. VDSL2, the most recently ratified version, doubles this again to an impressive 100Mbps downstream and up to 50Mbps upstream.

> "Fibre is the basis of the NBN, though technically you don't need to wait for the NBN to get it."

Nothing is free, of course, and the downside to VDSL is its reduced range compared to ADSL, typically effective up to 2km. However VDSL2 is not generally offered in Australia, with ADSL2 being the standard residential service and SHDSL or fibre the typical offering for business.

This may be about to change, however, if the current government continues on its path for FTTN (fibre to the node) for the NBN. Here VDSL2 will likely be used, as it has been overseas, as the last mile between fibre nodes and residential installations. Considering the impressive speeds VDSL can attain this may seem like a reasonable compromise, but keep in mind VDSL, just like ADSL, is beholden to line quality and distance reducing maximum throughput whereas fibre is not.

CABLE

Cable refers to coaxial cable and DOCSIS (data over cable service interface specification) services and is used for example with Foxtel. Cable can provide substantially better speeds compared to DSL technologies with a maximum downstream speed of some 400Mbps, though in Australia this is typically limited to 100Mbps for residential (business plans may be faster). This is also, obviously, why it's required for Foxtel's services but has the added benefit of providing fast internet

Back in the day, this was the Ferrari of the internet — the US Robotics Courier 56k.

access as well. Like fibre, cable must be laid to the premises, but unlike fibre there is already a wide cable network laid out and many buildings (especially apartments built in the last fifteen years) come pre-wired for cable.

Cable bandwidth is 'shared' among connections to the nearest node, and so it's possible to get lower speeds in times of heavy use. However this is frequently still faster than ADSL2+. It's also asymmetrical, and upstream speeds range from 2-20Mbps though residential is usually capped at 2Mbps. Telstra and Optus are primary cable internet providers in Australia, and plans aren't any more expensive than ADSL2 offerings (though you tend to get less data caps) — but you'll be limited by whether cable is installed, or can be installed, to a premises.

In terms of pricing cable internet is competitive to standard ADSL, with Telstra's plans for example starting at $73 for 50GB, while the 500GB plan costs $113.

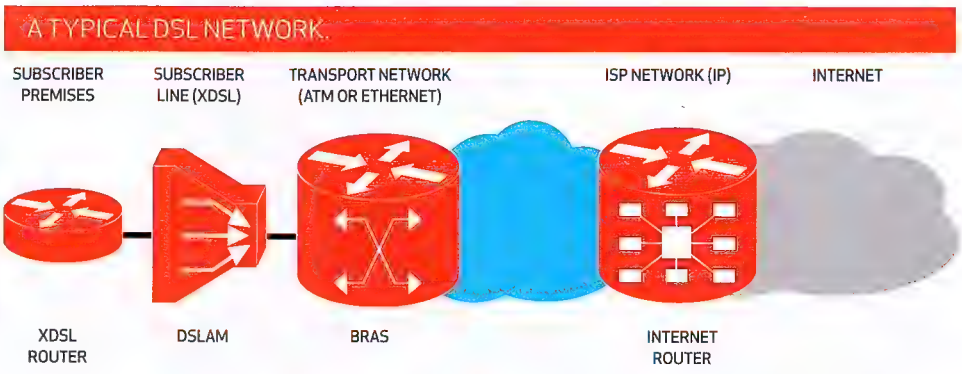
FIBRE

Fibre refers to fibre-optic, and is the fastest option among the technologies compared here. As a fibre-optic technology it doesn't suffer degradation over distance the way copper twisted-pair does, and it can transmit substantially faster with symmetric speeds too. Fibre is the basis of the NBN, though technically you don't need to wait for the NBN to get it — ISPs can lay fibre to your premises as part of their own fibre service — but this is an expensive option and one reason that fibre plans are business-oriented.

The roll-out of the NBN doesn't just involve the laying of fibre, NTU (network termination units) need to be installed at premises to accept the fibre link and provide a typical Ethernet output port. This means you don't need a modem (or rather, the NBN pays for it and it's a permanent fixture at a location).

In terms of cost we won't see really competitive pricing until more people are connected to the NBN, but at the moment ISP plans can differ significantly in what is offered both in bandwidth caps and in speed.

For business plans, as with SHDSL, costs are highly dependent on the level of service and the requirements for connecting premises to the network (fibre can be laid at expense). For residential, costs are cheaper but require a building already wired for fibre to participate. The speeds and costs are similar to NBN pricing — if you have access to fibre now, Internode's fibre plan at 100/40Mbps speeds for 300GB comes in at $125, for example, while iPrimus offers the same if you happen to be connected to the NBN at $99.



A typical DSL network from premise to internet. BRAS stands for Broadband Remote Access Server. *Source: Wikipedia.*

BUSINESS VS RESIDENTIAL

- Priority support
- Guaranteed availability (99.5%)
- Higher speeds depending on the connection medium
- Upload data may not count to a given quota
- No 'peak' and 'off peak' modes, and plans without quotas
- Priority on the network, and on international links
- Additional services like VPN, VoIP and mobile bundled in

WIRELESS 4G

Though technically not 'broadband', wireless 4G/LTE services are often bundled under the broadband moniker, especially with regards to marketing for business services. And not without good reason, given speeds can be as fast as 50Mbps or higher in ideal conditions. Of course, that's the rub with wireless being much more susceptible to service variations as well as being affected by distance, weather, interference and network load. It does, however, form part of the NBN backbone for areas that won't be laid for fibre, through the use of what NBN Co. calls 'fixed wireless' that should guarantee bandwidth to wireless users within a certain area.

Typically, mobile broadband expenses aren't cost-efficient. Plans on Optus for example cap out at 15GB at $55 a month. Costs vary also depending on if you're buying a SIM for a single device, or a mobile broadband modem and router to connect multiple computers.

SATELLITE

Satellite has traditionally been used for remote areas and, as you expect, requires the installation of a satellite dish to communicate. Where once satellite services relied on an old-school modem for upstream, today downstream and upstream are transmitted via satellite. Speeds typically max out at less than 1Mbps downstream and a fraction of this for upstream. Additionally, as a satellite service, there are comparably delayed response times (ping, round trip) compared to the other options covered here.

Installation is also expensive (up to $1,000 for modem and dish installation) and plans are severely limited in data caps — Telstra's 4GB monthly usage, for example, comes in at $500/month.

The obvious advantage to satellite, however, is that it can be obtained almost anywhere you can plonk a dish.

DSL technologies require DSLAMs installed at an exchange. *Image source: Wikipedia*

TESTING BONDED DSL

AS A MIDDLE GROUND BETWEEN RESIDENTIAL ADSL SERVICES AND MORE EXPENSIVE BUSINESS-ORIENTED SERVICES, WE DECIDED TO TEST IINET'S BONDED DSL AND SEE HOW IT COMPARES TO A REGULAR ADSL SERVICE.

To do this we had it installed at a residential location and tested the service over three months. iiNet paid for the installation and the ongoing service during this time.

And the result? Well, we'd like to report that there's lots to report, but it was a relatively painless installation experience and the performance was in line with what the service promised – as it combines two lines and two ASDL services, the subsequent bandwidth was very close to double what we measured with a single line. Still, we ran it through a bevy of speed and reliability tests.

In our test the residence was approximately 2.2km from the exchange which led to, with a single line, an average connection speed of about 8,200Kbps downstream and 1,023Kbps up. With the bonded DSL connection we frequently connected between 15-16,000Kbps for downstream and 2,046Kbps up.

BONDING EXPERIENCE

Installation required a new physical phone port to be installed in the premises, which a technician contracted to iiNet came to perform, and would usually require wiring to the street or the MDF room in an apartment block if there isn't already provision for a second line. Ours already had this, so the only other setup was the visit of a second technician to connect the line to the nearest exchange and enable the second port on the DSLAM.

According to iiNet, and as you might expect, each line is its own service and in that respect there's no guarantee that both lines will perform the same – the path it takes to the exchange may see it having more or less interference for example, and building wiring may also impact connection speeds. In our case though both lines synced very close together and were effectively interchangeable.

MODEM UPGRADE

The service requires a special bonded DSL modem, which iiNet supplies as a Zyxel P-663H-51. While it can act as a router like most ADSL modems, iiNet recommends setting it up in bridge mode, which is what we did. In bridge mode the Zyxel manages the ADSL connection, but then passes this off to a standard ADSL modem to perform logging in and creating an internet connection.

In terms of performance we essentially got double the downstream and upstream speeds. Downloading files, buffering for streaming data, browsing, and uploading large files all completed faster. Of these however it is worth noting browsing was the least improved – which is not unexpected. Often, you're waiting on the remote server, not limited by your local connection and page loads consist of multiple individual small elements as opposed to single large transfers.

We also wondered if the act of splitting packets across two

lines between the modem and DSLAM would incur a response time penalty, but there was no difference in ping times between the singe-line service and the bonded DSL service. This remained true even for online gaming, an obviously response-time sensitive pursuit.

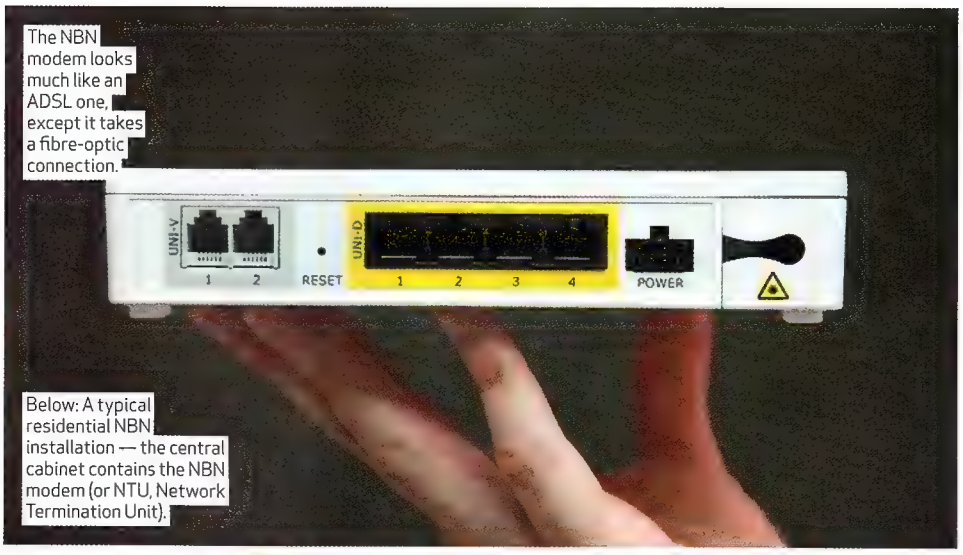
HOW STABLE ARE THOSE SPEEDS?

To test stability we ran extensive testing with pingplotter to measure consistency of ping over time with a range of local and overseas sites, though realistically the only viable results are to iiNet's own servers (as this removes any 'internet weather' from the equation). There was nothing to indicate the bonding service was better or worse for connection stability than a single line.

One element that did stand out for us is when we enabled Annex M in our testing. The result was a considerably reduced downstream speed, *and* a reduction in our upload speed, which it's actually supposed to increase. However, Annex M is also recommend for distances less than 2km and since our installation was beyond this limit we ultimately disabled it and left it off.

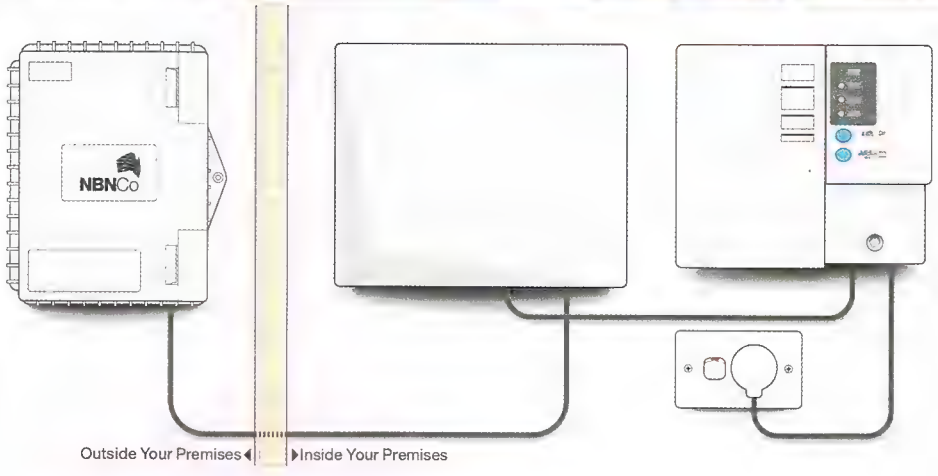
It's worth noting that utilising two lines the bonded DSL modem can fall back to one in the event of a line fault. This is good for staying online, however it's not automatic – you need to re-configure the Zyxel modem and call iiNet and have them switch the service over to a single-line profile. And as it happens we got to test out just this, as well the business-level support, during our testing period when one of the lines had a complete failure. We found out about it via iiNet support first who pre-emptively called us when the fault was detected and to let us know it was already being investigated, which was a nice change from being the ones calling the ISP to wonder where our connection went. The fault turned out to be a problem between the residence and the exchange, and was an outage that affected a number of streets in the area, necessitating waiting on Telstra engineers to fix.

Beyond this the testing period was uneventful, and the bonded DSL connection was exactly what we expected. The speed increase over a single-line is certainly noticeable, especially when downloading – but at what cost?



The NBN modem looks much like an ADSL one, except it takes a fibre-optic connection.

Below: A typical residential NBN installation — the central cabinet contains the NBN modem (or NTU, Network Termination Unit).



> "For the more hardcore residential users who can afford it, being able to double your speed without waiting for the NBN seems attractive"

IS IT AFFORDABLE?

A bonded DSL setup using naked DSL incurs a setup fee of $150, the modem is $419, and if a new line needs to be installed to premises another $299, leading to install costs between $569 and $868. The ongoing costs are of a Business Naked or Business Broadband2+ plan, with an added $99 per month flag-fall for the bonded service. So for example going with iiNet's Business Broadband2+ 250GB cap plan at $99.95 a month, you're looking at $198.95 a month ongoing. This is still faster and cheaper than the base SHDSL plans, but obviously more costly than iiNet's standard single-line Naked DSL service which comes in at $69.95 for a 250GB cap – a little under three times the cost for twice the speed.

For small and medium business or the more hardcore residential users who can afford it, being able to double your speed now without waiting five to eight years for the NBN certainly seems attractive. But then if you're willing to invest in a business-level service, you'll want to check out all plans available from multiple ISPs to see what other technologies and plans are on offer. Cable internet for example from Telstra and Optus can be considerably faster and cheaper, depending on availability. Ultimately, it comes down to how much you're willing to spend. ■

SUPER-SPEED WI-FI ROUTERS

WANT THE FASTEST WIRELESS NETWORKING AVAILABLE? NATHAN TAYLOR TESTS EIGHT 802.11AC UNITS THAT LEAVE WIRELESS-N MODELS IN THE DUST.

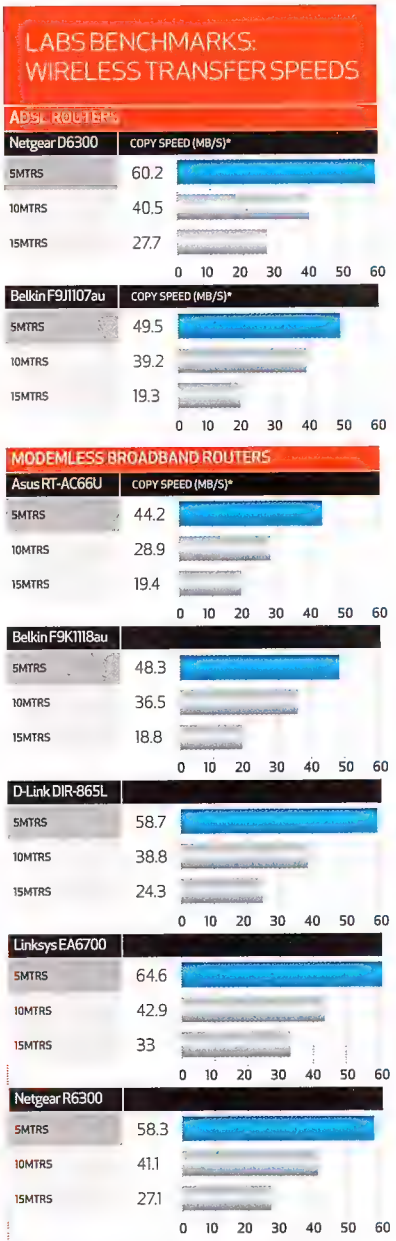
First introduced a little over a year ago, 802.11ac has come a long way. In 2012, virtually no network devices supported it, and if you wanted ac speeds you pretty much also had to buy adapters for your laptops. Now, things are finally starting to change.

Of course, were still a long way from the kind of ubiquity that 802.11n enjoys. Even now, only high end laptops support ac natively, and when it comes to mobiles, ac is still scarce. But there are a trickle of products coming out that support it. Samsung has been the most aggressive implementer of 802.11ac in its mobile products by far, with ac appearing in the Samsung Galaxy Mega, the Galaxy S4, Galaxy Note 3 and many more. LG also has a handful of phones and tablets that support it, including the LG Nexus 5 and G2. HTC's One Max has ac support, as do a handful of Sharp and Fujitsu phones. Sadly, Apple has yet to implement ac in iOS devices, and good luck trying to find ac in any tablet this year, but its introduction in current phones does point to a bright 2014 for ac in mobile devices.

And once you go ac, you can never go back. As our tests have proven repeatedly, 802.11ac is the real deal. Tested in the exact same environment as 802.11n routers, the 802.11ac routers we tested have consistently more than doubled the performance of 802.11n, both at short range and long. Where 802.11n can sometimes struggle to smoothly stream a single HD video wirelessly, an ac router will let you stream several at once.

As an added bonus, prices have come down a lot in the past year. There's still a significant premium on ac products, but where you were once often looking at $300+ for an ac router, most can now be had for between $200 and $300, with affordable models dipping below $200. If you want the best networking you can get in a consumer router, there's no longer any real barrier to entry.

> "Where 802.11n can sometimes struggle to smoothly stream a single HD video wirelessly, an ac router will let you stream several at once."



Tested using a 1GB file copy from PCs attached to router and a Cisco Linksys WUMC710 adapter/bridge.

WHAT DOES "HT40" AND "HT80" MEAN?

IF YOU LOOK AT THE SPECS OF A MOBILE DEVICE THAT SUPPORTS 802.11AC OR 802.11N, YOU'LL OFTEN SEE HT20, HT40 AND HT80 LISTED IN THE SPECS. SO WHAT DOES THAT MEAN?

In this case the HT stands for high throughput, and the number is the wireless channel size supported, in MHz. HT20 supports a 20MHz channel; HT40 means that a 40MHz channel size is supported; HT80 supports a channel size of 80MHz. Channels scale in a mostly linear fashion, so a HT40 wireless capable mobile will have wireless that's roughly twice as fast as an HT20 one.

The actual throughput depends on whether you're talking about 802.11n or 802.11ac. 802.11n supports 20 or 40MHz channels. If it's HT20, that means your likely speed is 72 or 75Mbps; HT40 means 150Mbps. (Technically there is considerable variation possible depending on modulation, guard interval and encoding schemes, but 75Mbps per 20MHz channel is a good rule of thumb to follow).

802.11ac supports 20MHz, 40MHz, 80MHz and (technically) 160MHz channels. But it's also more channel efficient than 802.11n. Typically, you can expect a HT40 ac mobile to be limited to around 200Mbps and an HT80 ac device to cap at 433Mbps.

These numbers assume that the wireless device has only a single antenna. Very few mobile devices have more than one, but we've seen a handful such as the Google Nexus 10 that support MIMO.

MIMO uses multiple antennas that add extra spatial streams, and can multiply the throughput several times over depending on the number of spatial stream supported.

$215 | WWW.ASUS.COM.AU

ASUS RT-AC66U

AN INCREDIBLE TOOL FOR ADVANCED USERS.

When we first looked at the ASUS RT-AC66U nearly a year ago, we were a little disappointed by its network performance. Although it has top wireless specs – 1300Mbps ac and 450Mbps n – it struggled in our test environment. Perhaps it's because of a year of firmware updates, or some change in our test environment, or maybe just luck, but the ASUS RT-AC66U did perform much better this time around. It is still, however, well behind the competition when it comes to wireless performance; at short range our fastest 802.11ac router was still 20MB/s ahead of the ASUS.

Which is a shame, because otherwise the ASUS has a lot to offer. There's a simple setup process, but if you're an advanced user that really likes to drill down into the settings, ASUS has the goods. Such fine details as QoS, VPNs, wireless transmit power and firewall rules are all highly configurable. Some users might find it appealing for the VPN support alone, but the wireless optimisation and traffic monitoring are also first rate and the kind of tools we rarely see in consumer routers. Clearly ASUS has taken its lead from open firmwares like DD-WRT and built something that an advanced user can really get their teeth into. Indeed, the ASUSWRT firmware shares a common origin with DD-WRT, and has gone from being an alternate firmware for ASUS routers to a primary one.

The router comes with two USB 2.0 ports, and thanks to the firmware they're highly functional. They support shared storage, with access through Windows file sharing (SMB) and DLNA, but they can also be used to share printers or access to 3G/4G modems. The ASUS even has a built in downloader that can pull BitTorrents and web downloads onto attached storage when your computer is switched off.

Verdict

Includes ASUS's outstanding firmware geared towards advanced users, but Wi-Fi performance was disappointing.

★★★★½

$235 | BELKIN.COM/AU

BELKIN F9K1118AU

A CONSUMER-FRIENDLY ROUTER.

A bulky router built in Belkin's now familiar upright art-deco style, the F9K1118au is a router built for consumers who want excellent speed but need a simple setup and easy configuration options.

We've always been impressed by Belkin's firmware. It retains a simplicity and clarity that a number of other router vendors should aspire to. It's not particularly deep, but we never have trouble finding any given feature in the web administration interface, or configuring it just how we want it. And with the way that Belkin packages the router, with cables already plugged in, secure wireless already configured and a straightforward five-step guide to setup, getting the Belkin router up and running could not be easier if it tried.

The router comes with a decent feature set, too. There are twin USB 2.0 ports on the back of the router (spaced a little too close together for our liking) into which you can plug storage devices. It can stream media to DLNA media players via an implementation of Twonky's media server, which ensures maximum compatibility with media players – we've never had problems connecting Twonky with anything. It also implements DNS-based parental controls from Symantec/Norton, which allows category-based filtering of web domains.

The router support Gigabit Ethernet on all four LAN ports and the WAN port as well. For wireless it goes to 300Mbps for 802.11n and 1300Mbps for 802.11ac, but we found the latter slightly disappointing in our tests.

It still absolutely blitzed any 802.11n router we tested, but compared to several other 802.11ac routers, the Belkin felt a little behind.

Verdict

Good parental controls and media server capabilities combine with easy setup and configuration tools.

★★★★½

"The 802.11ac routers we tested have consistently more than doubled the performance of 802.11n, both at short range and long."

apc RECOMMENDS

$195 | DLINK.COM.AU

D-Link DIR-865L

SOME ROUGH EDGES HERE AND THERE, BUT FAST AND CAPABLE.

An imposing black block of a router, D-Link DIR-865L eschews fancy industrial design in favour of pure intimidation. The D-Link looks powerful, and not without cause. In terms of networking, the D-Link has the most advanced technology available, including 1300Mbps wireless ac, 450Mbps wireless n and Gigabit Ethernet on all wired ports.

It put out very solid numbers in our tests. It didn't quite match up to the Linksys router, but it was on par with the Netgear routers and is more than capable of streaming multiple HD videos around your home at once.

Like Netgear and Linksys, D-Link also provides a cloud service for its routers. Called mydlink Cloud, the service lets you access your router settings and shared storage remotely, without having to fiddle with dynamic DNS or port forwarding. The implementation is not as smooth as Netgear's, but there are mobile apps available and access to a rich set of features through both the mobile apps and web interface.

The router has a single USB 2.0 port for shared storage, and you can access files on an attached USB storage device via DLNA or Windows file sharing. You can also access them through the cloud interface, which is a great way to access your files remotely.

D-Link provides a simple setup wizard, but you can also access some quite complex configuration rules if you've a mind. The web admin of the router is certainly not as clean as that provided by, say, Netgear or Belkin, but it also provides access to more details than those products. Parental controls are implemented through a built-in link to OpenDNS, a DNS service that can implement category-based filtering of objectionable web sites. It's an OK solution, but requires that you sign up to a third party service to run.

BACKWARDS COMPATIBILITY

Every router we've tested here is also backwards compatible with 802.11n (as well as b/g and a). That means they still work perfectly fine with all your existing devices, including ones that work in the 2.4GHz spectrum. While all ac devices use 5GHz, all the routers maintain 2.4GHz antennas for 802.11n compatibility.

Verdict

With top-speed networking and cloud capabilities, this has a lot of features, though is tricky to configure in parts.

★★★★½

MODEMLESS BROADBAND ROUTERS

$268 | LINKSYS.COM.AU

LINKSYS EA6700

A LITTLE BIT FASTER THAN THE REST.

Up until now, Linksys EA6500 was our speed king when it came to 802.11ac routers. A new king has been crowned. More than just an elegant design, Linksys' EA6700 was the fastest AC router we've ever tested – and in more ways than one.

In terms of networking support, the EA6700 has the fastest available everything: Gigabit for wired on all ports; 1300Mbps for 802.11ac; 450Mbps for 802.11n. And it was fast even for those speeds, beating every other ac router we've tested in the file copy test.

It also makes a little better NAS appliance than most routers thanks to another speed bump Linksys has implemented. It has two USB ports for shared storage, but for the first time we've seen in a router, one of those is USB 3.0 (the other is still USB 2.0). To see just what kind of difference that would make, we ran a copy test across Gigabit Ethernet to a USB 2.0-connected hard drive and then to a drive connected to USB 3.0. Copying to the USB 2.0 drive averaged 18.2MB/s. Copying data to USB 3.0: 38.4MB/s. For home where multiple HD movies may be streaming, that's a pretty big deal. The Linksys has a full DLNA implementation for file sharing, and supports Windows file sharing as well.

Like Netgear, Linksys has realised that people don't always want to use CDs or PC web browsers to set up their network anymore. So it has built a set of apps and online tools called Smart Wi-Fi that lets you control your router from your mobile devices or securely access router settings from anywhere. It's much more limited than Netgear's implementation, but still a welcome ability, letting you change things like parental controls on the fly.

Verdict

A feature-packed model that offers the fastest home networking money can buy, plus NAS and cloud capabilities.

$199 | NETGEAR.COM.AU

NETGEAR R6300

IF THEY JUST ADDED VOIP, THIS ROUTER WOULD HAVE IT ALL.

Although it has been a year since the Netgear R6300 first launched, it remains one of the best – if not the best – 802.11ac routers on the market. Netgear has clearly worked hard to make the R6300 the easiest to use, most consumer friendly router available. Most people will never use the advanced features of many routers; QoS, media sharing and parental controls are rarely touched features. But Netgear has made them accessible enough that everybody can make use of them.

A key component of that is the Netgear Genie app, available for iOS and Android. With Genie installed, we set up the router from our mobile in minutes, and could always access wireless settings, parental controls and get shared media onto our mobile. Of course, if you like to do things the old fashioned way, there's a web admin console as well that really lets you drill down into the details. You can also access media connected to one of the two USB 2.0 ports via Windows file sharing or DLNA media streaming.

The router's networking support is as good as it gets. All four LAN ports and the WAN port are Gigabit Ethernet, while top-speed 1300/450Mbps Wi-Fi is supported for 802.11ac and 802.11n devices. It ranked very highly in our 802.11ac test; the only router with a notable advantage over it was the Linksys EA6700.

Verdict

With top speed wireless for 802.11ac and 802.11n and easy to use mobile app, it's hard to find things to complain about.

ADSL ROUTERS

$298 | BELKIN.COM/AU

BELKIN F9J1107AU

A ROUTER WITH LACKLUSTRE WIRELESS PERFORMANCE BUT A FANTASTIC SET-UP.

Although the first 802.11ac routers started appearing over a year ago now, ADSL modem routers are still thin on the ground. In fact, Belkin's F9J1107au is only the second one we've ever reviewed, and the good news is that it's a capable entry into the field, delivering easy set-up and family-friendly features.

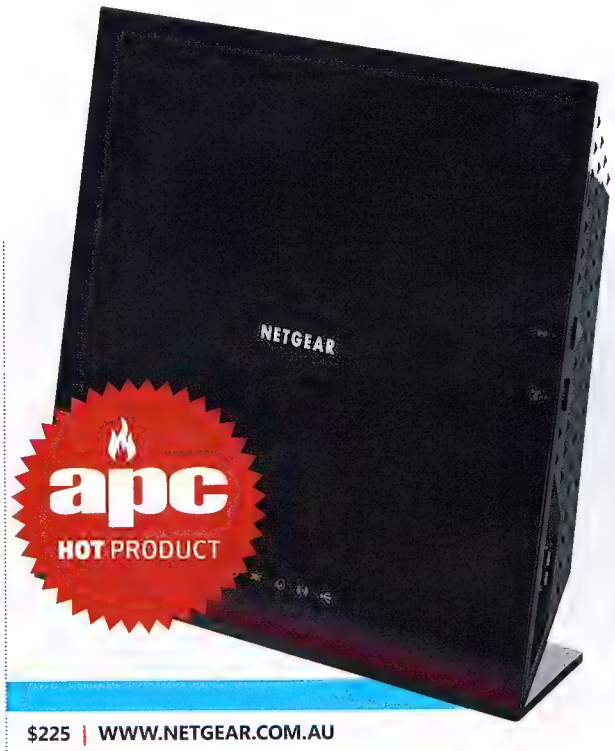
The F9J1107au is the DSL counterpart to the Belkin F9K1118au, and the specs and features of the two routers are nearly identical: 1300Mbps wireless ac, 300Mbps wireless n, Gigabit LAN ports, parental controls supplied by Norton, media streaming and shared storage from two USB 2.0 ports. Of course, in this case there's also an ADSL phone port rather than an Ethernet WAN port. It would have been nice if Belkin also provided an Ethernet WAN port in case of an NBN switchover (as has become the trend in many ADSL modem routers), but it has neglected to do so here.

All the good things we said about the F9K1118au setup apply here: Belkin has gone to some length to make initial setup as easy as possible, even going so far as to pre-emptively plug the power brick into the router. Unusually, the power brick also serves as the ADSL filter and phone line between filter and router, and you plug your phone line into it rather than the back of router.

Essentially setup involves taking the router out of the box, plugging the power brick into the power socket, and connecting your phone line to the power brick. It's an intelligent touch, and it means that there's only one cable running up to the back of your router rather than two (the cable splits to go into the modem and power ports). It looks so much neater than the normal setup where you have an array of cables hanging from the back of the router like cobwebs, and fewer parts to deal with will make the router considerably easier for non-technical people to set up.

Verdict

The wireless performance isn't first rate, but if you value easy set up and configuration this one's a top choice.



$225 | WWW.NETGEAR.COM.AU

NETGEAR D6300

A FAST ROUTER WITH A HOST OF FAMILY-FRIENDLY FEATURES.

The DSL version of the R6300, Netgear's D6300 has nearly all of the features that makes the R6300 such a great router: fast networking, excellent firmware, very cool support services. What's more, it even has a Gigabit Ethernet WAN port built in for NBN readiness, so it can literally do anything the R6300 can do, plus ADSL. The one notable difference is the 802.11n support is a tier lower in this product: it's limited to just 300Mbps. 802.11ac support is full 1300Mbps, however, and all LAN ports are gigabit.

As we noted in the R6300 review, Netgear has pretty much the best firmware in the business right now. The setup is as user friendly as a router can be, and there are a host of great family-friendly features like traffic metering, non-technical traffic prioritisation and real category-based parental controls. What's more, there's an app called Netgear Genie for iOS and Android that lets you set up your router without needing a PC, and lets you configure router elements live. It also lets you access and share storage devices attached to the router.

There are two USB 2.0 ports for attaching the aforementioned storage. You can also attach a shared printer. File sharing supports DLNA media streaming (which worked with the Xbox 360 and a Samsung television we tested it against) as well as Windows file sharing. In addition, you can access the files remotely by setting up ReadyShare Cloud, a service provided by Netgear that lets you log into and securely access your files from outside your home network.

The performance of the router was more than adequate in our tests. As we found with the Linksys EA6700, at short range your hard disk might actually be the performance bottleneck, and it's easily enough to transfer three or more HD video streams simultaneously.

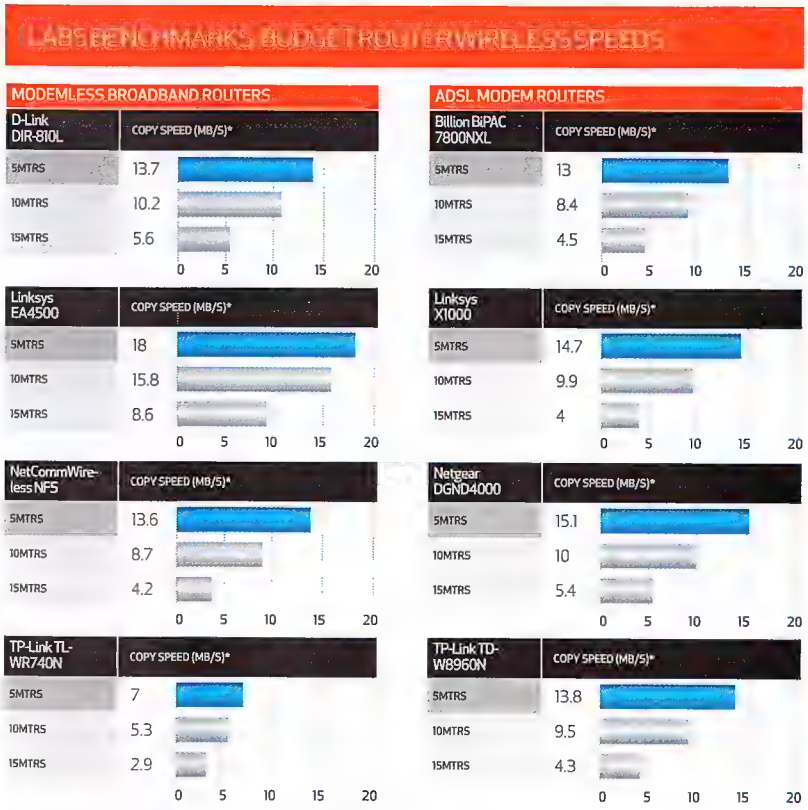
Verdict

Despite being limited to 300Mbps 802.11n, the excellent firmware plus host of features help make up for it.

ROUTERS ON A BUDGET

DON'T NEED 802.11AC? THERE ARE PLENTY OF AFFORDABLE ROUTER OPTIONS AVAILABLE.

In some cases, being an early adopter is for suckers. If you've got no wireless devices that support 802.11ac, there's a reasonable argument that you don't need to bother forking out the extra money to get a router that supports it (at least not yet). If all you need is a good old fashioned 802.11n router to get you through the day, there's a great range of budget-oriented options that can cover your needs – with some models starting at an astounding $20 on the street.



***Tested using a 1GB file copy from server to attached router and a PC with Netgear WNDA4100 USB adapter. Tested in 2.4GHz band.*

WHY IS MY MOBILE DEVICE SLOW?

Your router or access point may be capable of astonishing speeds, but your mobile phone or tablet seems to be getting nowhere near them. It's a common problem, and one for which there is no easy solution.

To achieve high speeds, wireless n and wireless ac use multiple antennas and multiple channels. The thing is, your mobile may not have space for more than one antenna, and it may use only a single channel to save on power. The upshot is that your mobile device may be limited to just 72Mbps or 150Mbps, and there's nothing to be done about it.

That's not to say it will always be the case. A handful of tablets, for example, have come out with multiple antenna support for full-speed wireless (the Google Nexus 10 is one such tablet).

In addition, 802.11ac supports much more data using a single antenna than 802.11n – theoretically 433Mbps and more is possible in the future.

apc RECOMMENDS

MODEM LESS BROADBAND ROUTERS

$77 | DLINK.COM.AU

D-LINK DIR-810L

AN AC ROUTER (KIND OF) AT AN N PRICE.

D-Link's DIR-810L is an odd bird. It's technically a dual-band 802.11ac router, but because of its price and the limits of its ac implementation we decided to put it here with the other affordable routers.

What makes it odd is that it uses the slowest implementation of 802.11ac possible: 433Mbps. It's the only router we've seen that supports this speed, all other ac routers we've ever reviewed have had a minimum 867Mbps throughput. That's not to say this is a bad choice by D-Link: 433Mbps 802.11ac is, for most people, a superior option to 450Mbps 802.11n. That's because when it comes to mobile devices, you'll likely never see one that supports 450Mbps n because of its antenna requirements; but we might see mobile devices supporting 433Mbps wireless ac.

For now, it will still support 300Mbps wireless n operation, and also has four 100Mbps Ethernet LAN ports. Its WAN port is also Fast Ethernet, making it unsuitable for use on 100Mbps NBN and cable services. It performed well enough in our wireless tests, holding good speeds at range when tested using 802.11n. We also tested its 802.11ac performance using the same tests we used for the other routers; as expected, it performed well below the rate of most others, but better than most n products. At 5m the throughput was 17.2MB/s, at 10m 13.3MB/s and at 15m 6.3MB/s.

Aside from its support of ac wireless, the DIR-810L comes without frills. There's a simple setup, and we quite like the mydlink cloud service that lets you configure your router remotely and from a mobile device. But there's really not much to manage: no USB ports and very few advanced features to speak of.

Verdict

A budget-priced model that supports (low speed) 802.11ac, though it has limited features and slow LAN speeds.

★★★★☆

apc RECOMMENDS

$160 | LINKSYS.COM.AU

LINKSYS EA4500

A GREAT ROUTER A YEAR AGO, BUT NOW ECLIPSED BY 802.11AC MODELS.

One of the first routers released to support 450Mbps wireless n in both bands, the Linksys EA4500 still holds up well today, producing excellent performance in our wireless tests. It's still on the expensive side for an 802.11n router, but it does offer elegant design (a hallmark of the Linksys routers), a good feature set and superior 802.11n performance.

Although we really like the feature set enabled by the firmware — including USB storage with DLNA sharing as well as sophisticated security and QoS options — we're not fans of the setup of the router.

The Cisco Connect CD installs an utterly unnecessary cloud-based admin app on your PC, yet you're almost forced to use it since the documentation doesn't come with a default IP address for the router (if you want to skip the CD, be prepared to Google details on the web setup).

Once you're set up, however, you'll have the best speeds that 802.11n technology can offer. The WAN port and all four LAN ports support Gigabit Ethernet, and its six internal antennas drove the 450Mbps wireless connection to heights unrivalled by its competitors. It's still eclipsed by the newer 802.11ac routers, but if your home networking devices are all 802.11n and have support for 450Mbps, you can't do much better than the EA4500.

Verdict

Setup can be a little clumsy and the price is a little high, but this elegantly designed unit is fast as 802.11n wireless gets.

★★★★☆

apc RECOMMENDS

$90 | WWW.NETCOMMWIRELESS.COM

NETCOMMWIRELESS NF5

AN UNUSUAL ROUTER WITH BUILT-IN VOIP AND 3G/4G SUPPORT.

We've been critical of some of NetCommWireless' design decisions in the past, but the Australian company has really brought it together for the NF5. Don't get us wrong – it's far from perfect – but it fills a particular niche very well, with a unique set of features that will appeal to a lot of people.

One of those features is integrated VoIP. VoIP integration has fallen out of favour on DSL modems, and we've never seen it before on a regular broadband modem like the NF5, but it really works here, with clear audio and a full set of VoIP features. We use VoIP services a lot, and having even a single integrated VoIP port like on the NF5 means you don't need yet another box cluttering up your home.

The other thing that the NF5 has is a USB port with full support for 3G/4G modems. The implementation of the 3G/4G interface is certainly superior to many of its competitors (like the Billion BiPAC 7800NXL), with fail-over and primary internet support.

The biggest problem we have with the NF5 is the interface. NetComm Wireless' firmware is still in need of work, and it could take the lead from someone like Netgear when it comes to setup and simplicity. In short, the NF5's firmware is too technical (especially the VoIP setup) and too prone to long pauses, leaving you wondering whether it has crashed or is just thinking.

The networking hardware behind the router is solid. The NF5 has Gigabit Ethernet on all ports, making it NBN ready, but it only supports 300Mbps wireless n in the 2.4GHz band. Its wireless performance in our tests was a little disappointing, but not so much to outweigh the unique benefits of the router.

Verdict

The wireless is a little sub-par, but this one is feature packed, with integrated VoIP and very good 3G/4G modem support.

★★★★½

$20 | WWW.TP-LINK.COM.AU

TP-LINK TL-WR740N

YEP, IT'S A WIRELESS ROUTER FOR JUST $20.

Far from the lofty heights of $300+ AC routers, we thought it might be interesting to take a look at the other end of the spectrum: a router that costs you less than getting a Pizza Hut meal deal home delivered (yes, we quite often value things on how many pizzas you could otherwise buy for the price).

With a street price of around $20, you can't expect much from the TP-Link TL-WR740N, and not much is exactly what you get. It's a single antenna wireless router, limited to just 150Mbps. It still has four Ethernet ports, however, and they and the WAN port support 100Mbps.

The firmware the router uses is the regular TP-Link firmware, and that has certain advantages, including a degree of configurability not commonly found in routers at this end of the value chain. That includes some relatively complex QoS and security settings. The router can also be readily set up as a wireless bridge using WDS, making it a decent option for expanding your home network to places it might not otherwise be reaching. As with the other TP-Link products we looked at, using the quick setup CD was relatively fast and painless, but if you want to dig into the deeper setting through the web admin you might need to brush up on your networking jargon.

Of course, with only a single antenna, the wireless performance of the TP-Link is limited. Next to the 300 and 450Mbps routers its numbers don't look good, but in truth it may not be a bad option if your only use for wireless is mobile devices like tablets and phones. Very few mobile devices have multiple antennae, so often 300Mbps and faster speeds go to waste.

Verdict

The networking speeds and web interface aren't great, but the price is frankly insane. This one could be used as a cheap network extender or switch.

★★★½☆

AFFORDABLE ADSL ROUTERS

$129 | WWW.BILLION.COM.AU

BILLION BIPAC 7800NXL

A ROUTER THAT DOES A LITTLE BIT OF EVERYTHING.

With Billion's BiPAC 7800NXL, flexibility is the name of the game. In addition to the ADSL port on the 78000NXL, you can plug a 3G/LTE modem into the USB port, and set that up to be either the primary or failover internet connection. If you've a need for a regular Ethernet WAN port, you can re-assign one of the four gigabit Ethernet ports to be a WAN port, with fully configurable PPP options for connecting to an ISP.

That flexibility extends into the firmware as well. As has historically been the case, Billion isn't big on hand holding during setup or regular maintenance, but if you've a little networking know-how, you can drill down further into the router settings than on just about any other commercial router firmware. It's not quite as configurable as some of the custom Linux-based firmwares like DD-WRT, but it's close, making the Billion ideal for people who like to configure their router just so. It even supports such esoteric features as virtual LAN segmentation and integrated IPSec VPNs for secure remote access to your network. Some of the USB storage options that are as sophisticated as we've seen and include full DLNA and SMB support.

When it comes to wireless, it's just as configurable. In addition to all the usual security features, it supports multiple SSIDs and repeater/extender capabilities for use as a second wireless access point in your home. Unfortunately for Billion, this flexibility is not backed up by the hardware – this is a single band router limited to 300Mbps. And even in that band, it did not perform very well in our tests, producing amongst the slowest copy speeds of the routers tested.

Verdict

Tremendously configurable and packing flexible connectivity options (including VPNs) but wireless could be better and it can be technical to set up.

$76 | LINKSYS.COM.AU

LINKSYS X1000

A MODEM FOR THOSE WHO WANT NOTHING MORE THAN TO PLUG AND GO.

Linksys, now part of Belkin, has always been a purveyor of a wide range of modem and router products, right up to cutting-edge consumer designs using the latest network technology. The X1000 is not one of those cutting-edge routers; it's at the opposite end of the spectrum.

Let's start with the good: the industrial design. It's fair to say that a lot of routers could not be uglier if they tried, but with its compact size, matte casing and elegant curves, this is not a router that you'll feel compelled to bury in the deepest nook of your basement. That's a big win for a lot of people.

But if you want anything other than entry-level networking hardware, you'll be disappointed by the X1000. Its limited to just 300Mbps in a single band for wireless, and the Ethernet LAN ports are 100Mbps only. What's more, there's only three of the latter, although there is an Ethernet WAN port in addition to the modem port. That makes it suitable for connecting to another modem, but because the port is only Fast Ethernet, it's not suitable for NBN plans above 50Mbps (the NBN requires gigabit WAN for full speed).

In terms of features, there's not much here. No USB support and nothing fancy. It makes the setup simple – and the Linksys setup wizard does a good job of getting you up and running – but does not give you a great deal of flexibility.

Verdict

You get the basics and nothing more (and only three LAN ports), but with solid wireless performance, easy set up and elegant design at a low price this one's easy to recommend.

apc HOT PRODUCT

$159 | WWW.NETGEAR.COM.AU

NETGEAR DGND4000

NETGEAR'S IMPLEMENTATION OF FAMILY AND SHARING FEATURES IS AS GOOD AS IT GETS.

For most people, routers are scary things. They just want to set up the router and forget about it forever, and rarely explore all the additional features that a router might have to offer. Netgear has come as close as any vendor to breaking that wall.

Like the other Netgear routers reviewed this issue, the DGND4000 has a fantastic feature set, perfect for home users. There's advanced quality of service features, basic traffic metering, DNS-based parental controls as well printer and remote storage sharing of devices attached to the router's two USB ports. Using any of these features is as easy as it gets. We're particularly fond of the file sharing implementation, which supports DLNA for media streaming to your DLNA TV or network media player, as well as supporting the ReadyShare Cloud service provided by Netgear, which lets you remotely access the files on storage devices connected to your router without having to go through the torturous process of setting up port forwarding or dynamic DNS.

We also really like the Netgear Genie app, which is a recognition of that fact that people don't always use their PC to set up their router anymore. Available for iOS and Android, Genie lets you access the kinds of router features you might want to access on a regular basis: traffic meters, parental controls, attached media and wireless security settings.

For all its firmware features, the specs of the Netgear are solid as well. It has four gigabit LAN ports and a separate gigabit Ethernet WAN port (in addition to the ADSL port) in case you need to upgrade to the NBN later. Its wireless supports 300Mbps in the 2.4GHz band and 450Mbps at 5GHz; tested in the 2.4GHz band is managed quite respectable results. We also tested it in the 5GHz band (where it supports 450Mbps) and received some very good results indeed: 19.1MB/s at 5m, 13.3MB/S at 10m and 6.8MB/s at 15m.

Verdict

It's a little expensive relative to other 802.11n routers, but with easy set up, good wireless performance and excellent family features this one gets a lot right.

$45 | WWW.TP-LINK.COM.AU

TP-LINK TD-W8960N

JUST THE BASICS, MA'AM.

TP-Link's industrial design has gone into some strange places of late. Once a purveyor of pretty much the ugliest modems you could imagine (rivalling Billion on that score), TP-Link has been trying out some new looks. Perhaps the strangest is the TD-W8960N, with a spacey block pattern on the top and sleeker curves than we're used to.

In spite of its unusual look, however, it's not a premium product —it's built for people for whom affordability is the primary criteria. It's only single-band wireless N at 300Mbps, its Ethernet ports are limited to 100Mbps and it has no USB ports or other premium options.

As with Billion, however, the lack of stellar hardware does not mean that a variety of advanced features can't be exposed in the firmware. There are definitely a host of unusual features for a router at this price, including live list-based parental controls, IPSec VPN support, virtual LAN segmentation and more. You can also re-assign one of the Ethernet ports as a WAN port, but since the Ethernet ports are only Fast Ethernet, this won't make the router NBN ready.

Unfortunately, drilling down into these areas can be a little terrifying — TP-Link provides an easy setup wizard, but if you want to configure anything more advanced than your wireless and ADSL then sadly you're on your own.

As you might expect from a product at this price, the wireless performance of the router was not stellar. Its wireless performance was certainly not an outlier, but it was pretty uninspiring.

Verdict

It's complex to administer and has limited networking speeds, but packs a quite advanced firmware for an insanely-low price.

COVERING THE BLIND SPOTS

SOMETIMES YOUR WIRELESS SIGNAL DOESN'T HAVE QUITE THE REACH YOU NEED. NATHAN TAYLOR TESTS RANGE EXTENDERS AND POWERLINE NETWORKING GEAR THAT CAN HELP BRIDGE THE GAP.

Generally speaking, the best way to improve your wireless network performance is to move your router. It's amazing how many people will bury their router in a corner of the home or even in a basement, garage or attic, when really the wireless network should be located somewhere near the physical centre of the house or office.

Of course, moving the wireless router is not always an option. That's when you can go to plan B. A range extender is a great way to push your wireless network into the nooks and crannies of your home that it wasn't reaching.

A range extender is at once a wireless access point and a wireless client. It creates its own wireless network that nearby devices can connect to. But it also acts as a client to your main wireless network, relaying data from its own wireless network to the primary network and vice versa. The idea is that you place it in a position where it can reach the primary network, and where other devices that couldn't reach the main network can still reach it. Let's say you have a point in your house at which you get no wireless reception. Put a range extender somewhere between the router and that position, and you'll fin you should be OK.

There is a downside to range extenders, however, and that's performance. The range extender is a relay, receiving and retransmitting wireless data on a separate network. Not only does that double the amount of data on the airwaves, thus reducing overall bandwidth, there's also a retransmission delay. If you're looking for a range extender to increase your network performance in weak zones in your house, you're probably going to be disappointed: they're much more about filling in black spots than boosting network performance.

If you do want good network performance in otherwise dark areas of your home, your better bet is to get a second wireless access point and link it to your main router by high-speed cable. Ideally, you'd link it via Ethernet cable, but if you hate cables you can also use a powerline connection to hook up the primary and secondary access points.

> "A range extender is a great way to push your wireless network into the nooks and crannies of your home that it wasn't reaching."

Powerline networking uses your home electrical network to transmit data. A powerline kit usually comes with a pair of adapters that plug directly into any wall sockets in your home; these have Ethernet ports into which you can plug other network devices. A device attached to one can speak to the other at high speed.

Current powerline devices are capable of transmitting data at up to 600Mbps. Like wireless, this degenerates based on the distance travelled and the condition and composition of your home, but in general it will be a lot faster and have much more reliable speeds than a wireless connection – which makes it a great option for linking a secondary access point to a primary.

POWERLINE ETHERNET

$129 | WWW.BILLION.COM.AU

BILLION BIPAC P108

A SOLID IMPLEMENTATION OF 500MBPS HOMEPLUG AV2.

Supporting the 500Mbps version of HomePlug AV2, Billion's BiPAC P108 is a more than competent implementation. Coming packaged as a pair, setup of the P108 was as easy as holding down the two sync buttons simultaneously. But if you're willing to drill down into the web configuration, you can also access quality of service (QoS) controls to better manage traffic priorities on your powerline network.

We tested it by copying a 1GB file three times between two P108s spaced 15m apart. Both source and destination PCs were directly connected to the P108 adapters by Gigabit Ethernet. The results were very good indeed: the transfer rate was 24.9MB/s, and that rate was utterly consistent, with no spikes, dips or dropouts.

Verdict

Web admin is a little rough, but the initial setup is easy and there's good quality of service and power saving features.

POWERLINE ETHERNET

$159 | WWW.NETCOMMWIRELESS.COM

NETCOMMWIRELESS NP507

THE FASTEST POWERLINE NETWORKING KIT WE'VE SEEN.

The NP507 from NetCommWireless has just about everything you could ask for in a powerline kit: fast speeds, a simple setup, an AC power pass through that means you don't have to sacrifice a power point to set it up.

And it is fast. It supports Gigabit Ethernet and 600Mbps HomePlug AV2 networking, as opposed to the far more common 500Mbps. Tested at 15m (as with the Billion), it hit an impressive 30.2MB/s copy rate, again with very little lag at copy start and with an utterly consistent transfer rate, making it perfect for HD media streaming.

Setting up the review kit was a easy at it gets. The NP507 adapters come pre-paired, so all you really have to do is plug them in. If you want to change passwords or add additional adapters, you can use a web-based admin console.

Verdict

'Plug and go' setup combined with very fast speeds make this an impressive offering. It's a little pricey though.

WIRELESS EXTENDERS

$90 | WWW.NETGEAR.COM.AU

NETGEAR WN3500RP

MORE THAN JUST A WI-FI RANGE EXTENDER.

Netgear's rather bulky WN3500RP is about as feature-rich as a range extender gets. It's still only 300Mbps wireless n (sadly, we have yet to see an 802.11ac extender), but it has additional features that set it apart from the pack, including dual band support, a USB port for printer sharing and an analogue audio jack that you can use to stream music from your DLNA server. Attached to a stereo, it allows you to stream music from your PC to the speakers with playback controlled by the Netgear Genie mobile app.

We tested the extender with a Belkin BoB2, with the Netgear placed 8m from the access point and the test laptop placed 15m from the access point with three intervening walls. It transferred data at 3.3MB/s at that range, with a consistent three-bar signal strength. Connecting to the access point directly, we managed to transfer data at 3.5MB/s, which was actually better than with the range extender, but we only had one bar and the connection dropped completely during one test.

Verdict

While it's physically large, it offers decent speeds alongside printer sharing and network music streaming features.

WIRELESS EXTENDERS

$39 | WWW.TP-LINK.COM.AU

TP-LINK TL-WA850RE

A CHEAP AND CHEERFUL WI-FI EXTENDER.

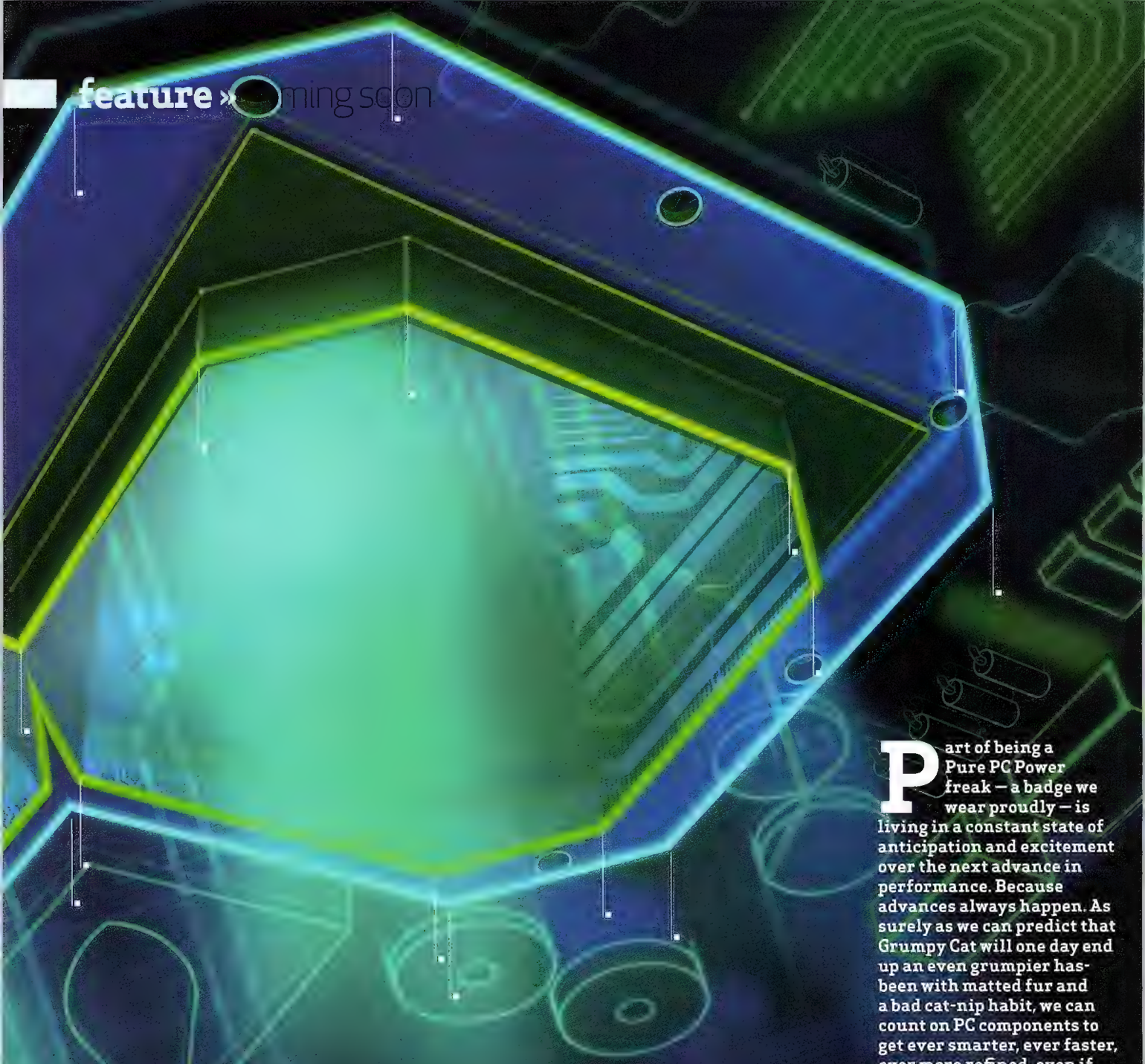
The TP-Link TL-WA850RE doesn't have all the features of the Netgear WN3500RP. It's single-band 300Mbps only, and lacks USB or media streaming, but it's also less than half the price of the Netgear, is more compact and includes one of our favourite features: a smart signal indicator light that is really useful for placing the extender in the best spot. Just use the web-based wizard configure the TL-WA850RE to connect to your wireless network, then move it from power-point to power-point and see which places give you the best signal.

The TL-WA850RE is also considerably more configurable than the Netgear, with advanced security and SSID options for the extended network.

Using the same testing method as the Netgear, it achieved 2.3MB/s transfer rate. That's well below the Netgear's speed, but certainly enough for web browsing and even some SD media streaming.

Verdict

Performance is a little lacking, but the low cost helps and a signal strength indicator makes it easy to position.



COMING SOON

A FAMILY OF UNLOCKED PROCESSORS, A SLEW OF FASTER INTERFACES, NEW GPUS, AND AN ATOM THAT DOESN'T SUCK!

Part of being a Pure PC Power freak — a badge we wear proudly — is living in a constant state of anticipation and excitement over the next advance in performance. Because advances always happen. As surely as we can predict that Grumpy Cat will one day end up an even grumpier has-been with matted fur and a bad cat-nip habit, we can count on PC components to get ever smarter, ever faster, ever more refined, even if those advances aren't being live-blogged. That's just the way of technology, and yay for that!

This month, we seek to uncover how this inevitable progress will play out for the PC over the coming year — what it will mean for our frame rates, bandwidth, and everyday workloads. With that in mind, we pressed our most trusted industry contacts for intel. We asked the tough questions; we even greased some palms. We also got hands-on with some upcoming hardware. In other words, we gathered a sufficient cache of intelligence to make some pretty good guesses and even a few outright assertions about the technology that will be rocking the worlds of PC enthusiasts in 2014.

The X79 chipset is the one main weakness of Ivy Bridge-E and LGA2011, as it only offers two SATA 6Gbps ports.

IVY BRIDGE, MEH?

INTEL'S ENTHUSIAST IVY BRIDGE-E IS HERE, BUT IT MAY NOT MATTER WITH HASWELL ON THE SCENE

THE RELEASE OF Intel's Ivy Bridge-E series of chips is about as anticlimactic as you can get: It's a chip based on a microarchitecture that isn't just going out of style — it already is out of style. It's a bit like trying to woot over the 2011 coupe when it's sitting next to the 2013 model on the showroom floor.

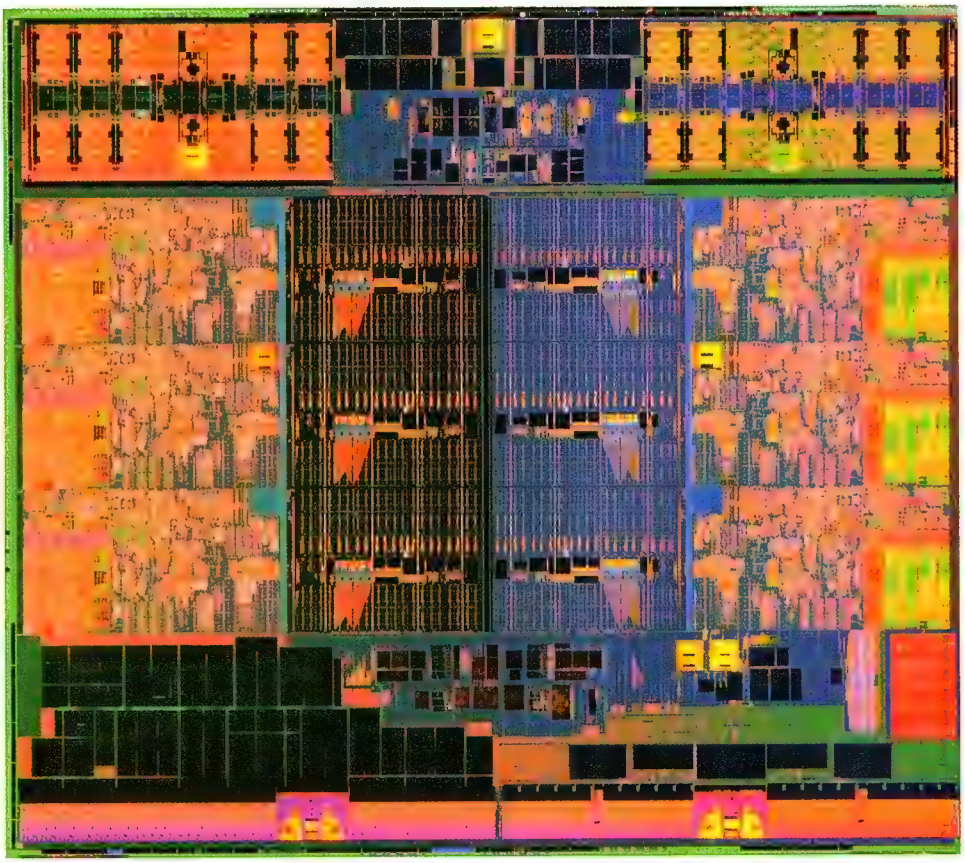
But don't let all the negative waves get you down; IVB-E still has its advantages. As good as Haswell is, it can't be found in the big-boy socket LGA2011 trim — Haswell only slides into LGA1150 sockets. To make Ivy Bridge-E even sweeter, Intel has also taken the unprecedented move of offering all the new Ivy Bridge-E chips unlocked. Previously, only the Extreme Edition parts were fully unlocked and the LGA2011 K parts partially unlocked. This time around, even the four-core Core i7-4820K will be fully unlocked.

Of course, if you read our review of Ivy Bridge when it came out (umm... 16 months ago), you already know the story: 3D transistors, a newer 22nm process, and a healthy stride forward in graphics. But since Ivy Bridge-E doesn't have the graphics core, the only real bump is from the x86 side. Even there, Intel described the update as a marginal "tick" upgrade in performance.

Still, Ivy Bridge instantly replaced the Sandy Bridge parts as our go-to processor, even if it wasn't the 25 percent improved-performance high enthusiasts have been chasing since the Core 2 and Nehalem Core i7 days, and we expect the same to be true of Ivy Bridge-E: If you're building a new machine, there's simply no reason to buy Sandy Bridge-E unless you're getting a hell of a price on it.

The platform itself still has an edge over the Haswell Core i7-4770K platform. With its quad-channel memory controller, you can pack up to 64GB on LGA2011 boards — Haswell is limited to 32GB. Those who need a buttload of PCIe expansion should also look to Ivy Bridge-E with its 40 lanes of PCIe goodness — Haswell offers but 16. And yes, Ivy Bridge-E finally brings official PCIe 3.0 support. Intel would never certify PCIe 3.0 on Sandy Bridge-E, though it could be enabled with a hack; with Ivy Bridge-E, it's official.

The other good news is that it looks like Ivy Bridge-E is a



Unlike Sandy Bridge-E CPUs, which use eight-core chips with two cores turned off, Ivy Bridge-E CPUs feature just six cores.

drop-in part. Just update the board's UEFI to one that supports Ivy Bridge-E and drop in the chip. That is, as long as you're not rocking an Intel X79 board. With Intel exiting the motherboard business, there's literally no one left to update its X79 boards to support Ivy Bridge-E on the LGA2011 DX79SR. Folks with ASUS, Gigabyte, *et al*, however, should be fine.

Inside the CPU, Intel basically took the Ivy Bridge microarchitecture and designed it around six cores instead of four. Like Ivy Bridge, there's a bit of a reduction in overclocking headroom. Many Sandy Bridge and Sandy Bridge-E parts could reach up near 5GHz with enough cooling. Ivy Bridge-E doesn't clock-up quite as high but also doesn't seem to hit the same issues that overclockers had trying to push Ivy Bridge CPUs to the 5GHz mark. The reason could be the larger die size. With its additional two cores, Ivy Bridge-E CPUs have more meat to put in contact with the heat spreader. Some have speculated that Intel's cheapening of thermal compound hurt the original Ivy Bridge parts' overclocking capability, but we think the jury is still out on that since we've seen evidence that it didn't really matter what the thermal compound was.

Ivy Bridge-E also offers significant power savings over Sandy Bridge-E components. We've generally been pretty indifferent to power savings on platforms designed to run 64GB of RAM, four hard drives, two SSDs, two GPUs, and enough fans to qualify as a S.H.I.E.L.D. Helicarrier, but Ivy Bridge-E power savings is a noticeable 25 percent by all reports. That's nothing to sneeze at when your box is sucking down 150 watts at idle.

Perhaps the sleeper feature in IVB-E is the per-core overclocking. This lets you fine-tune overclocks from within the OS in real time. With Sandy Bridge-E, OS-based overclocks required a reboot to take effect. With Ivy Bridge-E, a chosen overclock is immediately executed.

It's possible that eventually you'll be able to overclock cores based on the applications that are launched. If a game uses only two threads, you could potentially overclock two cores to far higher clock speeds

IN OTHER CPU NEWS...

For desktop computing, the next year should be fairly steady. Intel will continue to push LGA1150 as its primary mainstream platform with its Haswell CPUs. And as you've read, Ivy Bridge-E handles enthusiasts' needs for the rest of 2013 and well into 2014. LGA2011, though, will likely be replaced later next year with LGA2011-3. If you're an LGA2011 user, it's not really clear if the two sockets are compatible. What we do know is that LGA2011-3 supports DDR4. Some leaks have indicated there may well be some backward compatibility, allowing you to drop a Haswell-E into an Ivy Bridge-E socket, but we don't think that's very likely. It would require Intel to build DDR3 memory controllers into all of its CPUs to offer the compatibility. Intel has long shown a propensity for requiring consumers to buy a new motherboard, too. Witness the multiple, multiple chipsets for LGA775, not to mention the LGA1156 to LGA1155 move.

And frankly, as much as we like socket compatibility, we're not so sure it would make sense here. To quote Captain Marko Ramius: "When he reached the New World, Cortes burned his ships. As a result, his men were well motivated." LGA2011 is two years old and woefully lacking in modern amenities such as USB 3.0 and more than two SATA 6Gb/s ports.

Historians, however, would tell us that Captain Ramius was wrong and Cortes did not burn his ships, so maybe, just maybe, Intel will offer Haswell-E with support for LGA2011.

In AMD land, there have been murmurs that the company may put a stake in AM3+ by not offering its upcoming Steamroller microarchitecture in AM3+ trim. The question has been rolling around the internet for months, with many speculating that AMD will indeed backpedal on its earlier commitment to support AM3+ through another CPU cycle. We tried to get clarification from AMD, but the company gave us no real guidance. One good sign is that our chats with vendors seem to indicate that nothing has changed on the AM3+ roadmap, so maybe, just maybe, we'll see another AM3+ part next year.

because you know the other cores won't be hot.

No matter what, Ivy Bridge-E isn't a game-changing chip. For that to have happened, Intel would have had to offer an eight-core version of the CPU with a high TDP. It would have required liquid cooling to run overclocked but it would have given the power users, the enthusiasts, the red meat they've been craving.

Still, Ivy Bridge-E is not a step backward; it's a step forward. To find out how much of a step forward, read on.

IVY BRIDGE-E BENCHMARKED

For our tests, we used the same GPU, same driver, and same SSD across all the different platforms, running Windows 8.1. We limited our CPU choices to the natural competition for the new Core i7-4960X: the six-core Core i7-3930K and the four-core Core i7-3820 – both on LGA2011. We also decided to throw in the new Haswell Core i7-4770K and the original four-core Ivy-Bridge Core i7-3770. For additional perspective, we also tossed in a dual-core Ivy Bridge Core i3-3220 CPU.

If we had to absolutely declare a winner, we'd call it for the new Core i7-4960X, with the Haswell Core i7-4770K coming in a very close second. But the full performance story is far more complicated. Looking at just the single-core performance in Cinebench 10, the Core i7-4960X is pretty much on par with the Core i7-3770K. When you get to heavily multithreaded tasks, the six-core Core i7-4960X rules them all. The problem is that while the six-core chip more than pulls its weight in video encoding, 3D modelling, and other workstation-level apps, the Core i7-4770K is the better choice for most everything else. And let's face it, the vast majority of people aren't transcoding video all day long, so for them it makes sense to go with the modern chipset and generally better performance in most apps and games.

"If we had to absolutely declare a winner, we'd call it for the new Core i7-4960X, with the Haswell Core i7-4770K coming in a very close second."

That doesn't mean we're not recommending the Core i7-4960X. In fact, there are a few areas where the chip can't be touched by anything else. The per-core overclocking tied to applications might also mature to the point where it easily spanks the four-core chips in less-threaded tasks, too. We'll go with the same recommendation we've been making for a while: If you make a living pushing pixels, or need access to more RAM and a lot of PCIe lanes for add-in cards, go with Core i7-4960X or the Core i7-4930K. If your workloads are more conventional and you primarily game with two or fewer graphics cards, Core i7-4770K is the more prudent path based on price-to-performance ratios. Folks on tighter budgets, or those who are 90 percent gamers, who don't need the threads for encoding or transcoding, should consider the Core i5-4670K.

One final scenario would be if you're building a box for personal use and intend to upgrade to a six-core or possibly even eight-core Xeon in the future, then the LGA2011 with a Core i7-4820K gives a good upgrade path for those who need more cores.

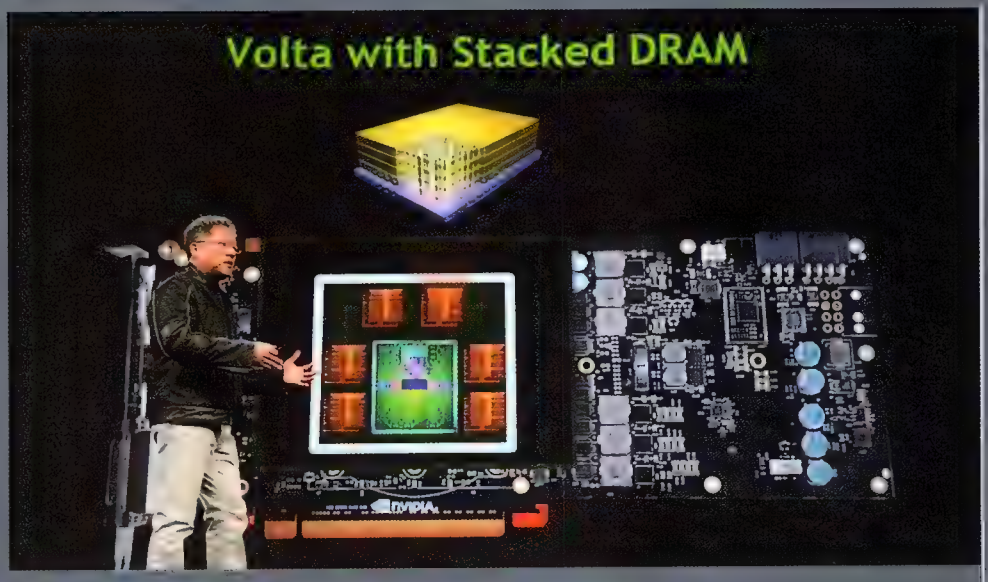
We don't want to leave you with the wrong impression, though: The Core i7-4960X is without a doubt the fastest CPU in town. It does it with less power than previous chips, and for those who really want to roll a mega-gaming machine with four GPUs in it – there's really no other choice. But we'd be far happier if the CPU came out six months ago and, frankly, if there had been an option for an eight-core CPU version.

MEET THE IVY BRIDGE-E CLAN

	CORE I7-4960X	CORE I7-4930K	CORE I7-4820K
CLOCK	3.6-4GHZ	3.4-3.9GHZ	3.7-3.9GHZ
CORES/THREADS	6/12	6/12	4/8
CACHE	15MB	12MB	10MB
TDP	130 WATTS	130 WATTS	130 WATTS
PRICE	$1,199	$669	$379

CPUs COMPARED

	CORE I7-4960X	CORE I7-3960X	CORE I7-990X	CORE I7-4770K	CORE I7-3770K	CORE I7-2700K
CLOCK	3.6-3.9GHZ	3.6-3.9GHZ	3.46-3.7GHZ	3.5-3.9GHZ	3.5-3.9GHZ	3.5-3.9GHZ
MICROARCHITECTURE CODE-NAME	IVY BRIDGE-E	SANDY BRIDGE-E	GULFTOWN	HASWELL	IVY BRIDGE	SANDY BRIDGE
CORES/THREADS	6/12	6/12	6/12	4/8	4/8	4/8
TRANSISTOR COUNT	1.86 BILLION	2 BILLION	1.17 BILLION	1.6 BILLION	1.4 BILLION	995 MILLION
DIE SIZE	257mm²	435mm²	240mm²	177mm²	160mm²	216mm²
L2 CACHE	1.5MB	1.5MB	1.5MB	1MB	1MB	1MB
L3 CACHE	15MB	15MB	12MB	8MB	8MB	8MB
PROCESS	22NM	32NM	32NM	22NM	22NM	32NM
TDP	130 WATTS	130 WATTS	130 WATTS	84 WATTS	77 WATTS	95 WATTS
SOCKET	LGA2011	LGA2011	LGA1366	LGA1150	LGA1155	LGA1155
MEMORY CONTROLLER	QUAD-CHANNEL	QUAD-CHANNEL	DUAL-CHANNEL	DUAL-CHANNEL	DUAL-CHANNEL	DUAL-CHANNEL
PRICE	$1,199	$1,000	$1,050 (EOL)	$379	$389	$360 (EOL)



NVIDIA GETS BUSY WITH MAXWELL

NOT MUCH IS KNOWN ABOUT THE SUCCESSOR TO KEPLER, BUT WE DO KNOW IT'LL BE THE FIRST GPU OF ITS KIND

AS WE CLOSE the year 2013, Nvidia has just finished launching its second round of Kepler cards in the GTX 700 series. We believe there are still two cards coming in that series, for the low end and the high end, and then the company will move on to Kepler's successor, code-named Maxwell. Though we don't know much about this new architecture yet, we are fairly confident it will be the first GPU to be offered using TSMC's new 20nm lithography process.

There is speculation that delays in getting 20nm up and running might cause Nvidia to stick with the current 28nm process for Maxwell, but it seems impossible for the company to achieve the kind of generation-to-generation performance improvements it needs to have by sticking with the same 28nm process it used for its Kepler technology. Furthermore, Nvidia has always switched to a smaller process for a new generation of GPUs (Fermi was 40nm, Kepler was 28nm). The move to a smaller process will bring the traditional benefits: higher performance along with significantly reduced power consumption. If you thought Kepler was amazing at performance-per-watt, Maxwell could be twice as efficient, if not more so.

Of course, smaller process, faster, more efficient... all of that is expected, but what will really set Maxwell apart from every GPU that has come before it are two things. First, it will be the first GPU to sport a 64-bit ARM CPU that Nvidia has been developing for many years now, named Project Denver. The CPU will be integrated into the GPU die and it's referred to in reports as a "general-purpose core." Second, the key feature of the entire Maxwell architecture is something Nvidia calls "Unified Virtual Memory," which will allow the GPU and CPU to share a common pool of memory. The goal of the memory pool is to allow the CPU to access the ultra-fast GDDR5 memory used by GPUs, and vice versa. Both the host CPU and GPU will still write to their own memory, but the two will now share a virtual layer of memory that both can access.

The shared memory will improve performance over a wide range of applications since, theoretically, data will no longer need to be copied to and from the GPU and CPU to be processed. It's also likely that the main beneficiaries of this technology are devices that integrate a GPU and a CPU, such as tablets, smartphones, and the like. In fact, Nvidia's mobile roadmap indicates that two generations from now, its Tegra chip, code-named Parker, will employ both a Denver CPU and a Maxwell GPU, so the move to integrating a CPU with the GPU is clearly a form of convergence that Nvidia can drop into another platform. Whether or not Project Denver will benefit gamers remains to be seen, as most reports indicate it's primarily something that's needed for server applications and other compute applications. In fact, it's apparently so compute-specific that there is speculation that lower-end Maxwell GPUs will forego the ARM CPU altogether.

After Maxwell comes Volta, which will feature DRAM placed on the same silicon substrate for insane memory bandwidth.

After Maxwell, Nvidia will introduce an architecture named Volta that moves the GPU's DRAM directly onto the same silicon substrate as the GPU die, which will dramatically increase bandwidth and reduce latency since the DRAM will literally be right next to the GPU die. It will pave the way for a memory bus that is 1,024 bits wide, for example, with memory clocked at 8GHz. Nvidia says it expects memory bandwidth up to 1TB/s for Volta — for reference, the GTX Titan currently allows up to 288GB/s, so Volta will be significantly faster.

Going back to the GTX 700 series, when Nvidia launched the GTX 760, it made a point of noting it was done launching products for the winter, which was odd. The company usually leaves these things open in case it needs to counter-attack a surprise AMD launch, but winter has come and gone with no word from AMD or Nvidia.

However, there are still two massive holes in the 700-series lineup, at both the high end and the low end. Reports indicate we'll be seeing both a GTX 750 Ti coming in at $200 or so to replace the GTX 650 Ti, and that we'll also get a dual-GPU behemoth, as well. Nvidia has always had a dual-GPU card bearing two of its fastest cores in its lineup, and so far hasn't announced anything for its 700-series cards, leaving us to speculate about the GTX 790. We don't think it'll consist of dual Titans due to cost, but dual GTX 780s is certainly possible. Whether Nvidia can make this card squeeze into the $1,000 price-tag dress these cards have always worn remains to be seen, but our guess is that AMD's new GPUs will put enough pressure on Nvidia to release the hounds.

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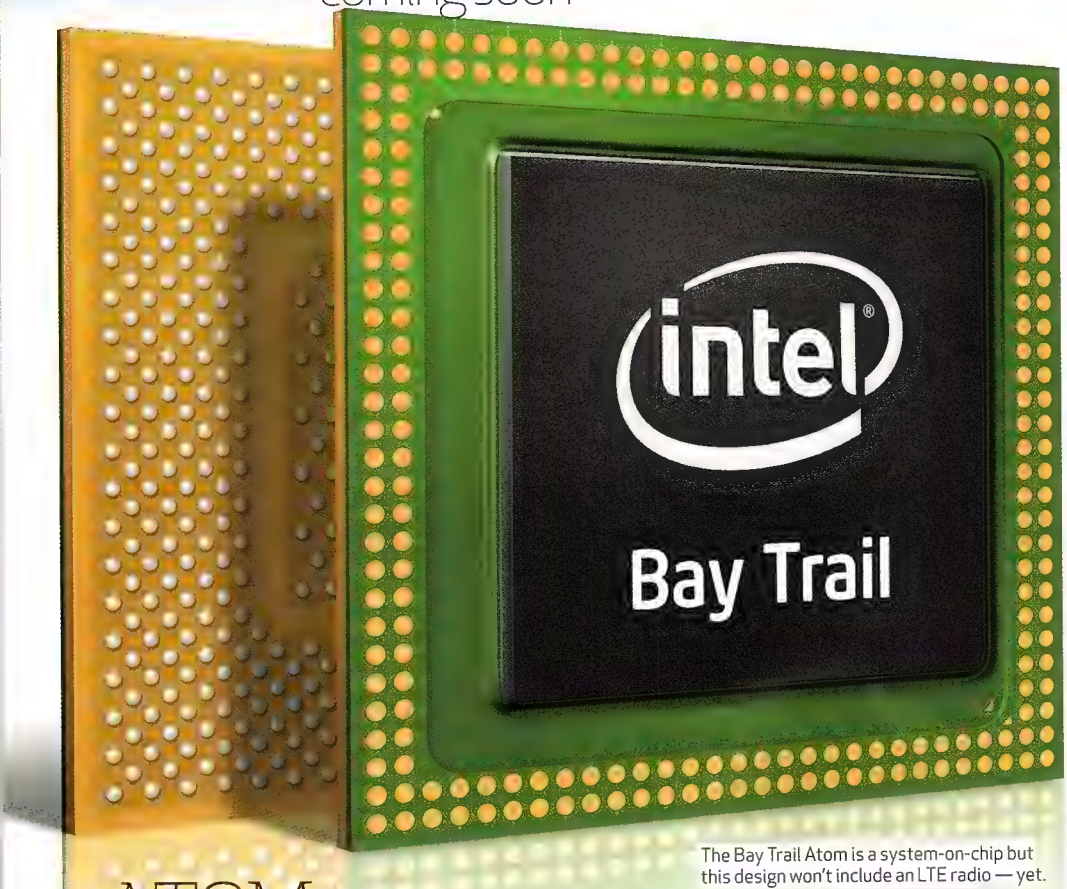


The Bay Trail Atom is a system-on-chip but this design won't include an LTE radio — yet.

ATOM PART DEUX

EXPECT WAVES OF INEXPENSIVE X86 TABLETS TO FOLLOW

SURE, ENTHUSIASTS are excited to finally get Ivy Bridge-E, and even giddy over Haswell, but the most important CPU for Intel this quarter might actually be its lowly Atom chip, code-named Bay Trail.

Bay Trail is a true redo of Atom, which was originally designed to power those horribly sucktastic netbooks, from as far back as 2007. The biggest architectural change for Bay Trail is its adoption of an out-of-order design CPU core, rather than the in-order design Atoms have used previously.

What's the diff? Think of an in-order CPU as a buffet line where you politely wait your turn as the person in front of you gets his rubbery chicken, mashed potatoes, and steamed broccoli. Even though you don't want any of that and would rather jump straight to the chocolate brownie at end of the buffet, you're forced to wait for the doddering fools in front you to plod along. With an out-of-order design CPU, it's a Las Vegas free-for-all buffet. There's no line to politely wait in, you can just jump straight to the dessert with no raised eyebrows or glares from your wife.

Out-of-order CPU designs have traditionally yielded the most performance but they also cost more in power consumption. That's one of the reasons Intel initially chose to build the original Atoms as in-order chips. In fact, most ARM SoCs powering tablets and phones have been in-order design until recently. But with Intel and ARM customers all using performance as a key metric for comparing tablets and phones, out-of-order has become the order of the day. It doesn't come without costs, though. As ARM chips have adopted higher-performance techniques, they've also started to consume more power.

This is where Intel hopes it can finally catch a break in its war with ARM, and Bay Trail is the CPU it hopes will turn the tables in its favour.

Bay Trail promises to offer CPU performance that crushes the fastest ARM chips, while providing the power efficiency we've come to expect from tablet SoCs. In tests of the Atom Z3770, the chip consumed 2.6 watts while running Cinebench 11.5 in Windows 8.1.

Besides power, another challenge for Bay Trail will be pricing, but Intel has apparently risen to that challenge, too. Tablets using Bay Trail chips are starting to hit the market at amazingly attractive prices. ASUS just announced its Transformer Book T100. The Windows 8.1 convertible features a 10.1-inch IPS panel at 1,366 x 768 and comes with the Bay Trail–based Atom for $579 with 32GB of storage. And that is but one of the many Bay Trail–Atom tablets expected by this holiday season — Intel predicts Atom-based tablets to hit as low as the $100 mark (which OS, the company didn't say). But will Bay Trail tablets be enough to turn around the tepid consumer demand for Windows 8? We'll have to wait and see, but Intel also expects manufacturers to build tablets around the x86-version of the Android OS. Take Dell's new Venue 7/8, for example, which will feature the Android OS, an IPS screen, and an Atom CPU for US$150, with 16GB RAM.

The final question for Bay Trail is its performance. We had a choice of two options for benchmarking Intel's new Bay Trail SoC: with Windows 8.1 or with Android 4.2.2. Frankly, no matter what you think of Windows 8/8.1, competing with AMD isn't Intel's problem — it's competing with the dozens of ARM vendors on Android.

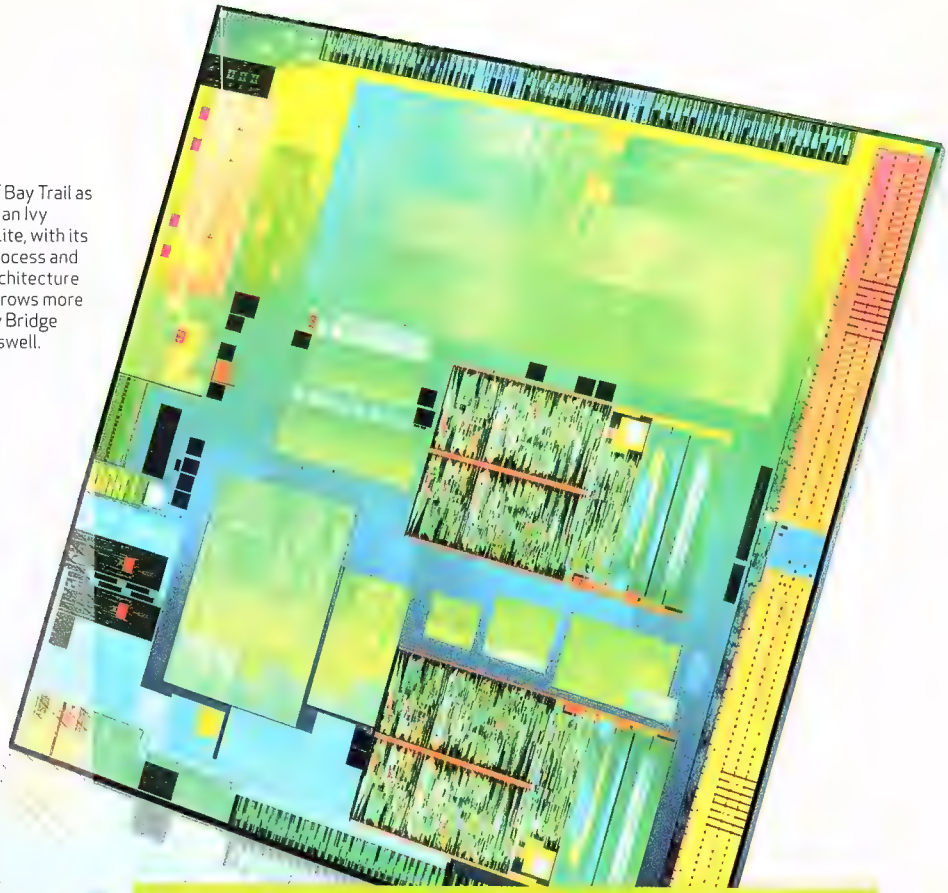
To get a feel for how Bay Trail will fare in that arena, we used a reference design tablet from Intel equipped with an Atom Z3770 and running Android 4.2.2. The tablet itself is simply a Windows 8.1 tablet with a custom loader to allow the unit to boot Android. And no, you probably can't dual boot Windows 8.1 and Android, from what we're told.

We compared the Bay Trail reference tablet to both the original and 2013 versions of the Nexus 7 as well as Nvidia's Shield. The Shield runs the new Tegra 4; the Nexus 7 Mk. I is powered by a Tegra 3; the Nexus 7 Mk. II features a Qualcomm Snapdragon S4 Pro. Android benchmarks are far from the maturity of PC benchmarks, so we cast a pretty wide net to gauge performance of the Bay Trail SoC.

Once we crunched the numbers, we decided that in tablets, the Bay Trail pretty much crushes the competition in graphics and CPU performance – including the Snapdragon S4 Pro in the Nexus 7 Mk. II, which is considered among the fastest, if the not the fastest, SoC running in Android trim.

But, you're saying, Nvidia's Tegra 4 actually manages to clock-block the Bay Trail in numerous benchmarks. Yes, it's true that the Tegra 4 outpaces the Bay Trail in graphics performance, but on CPU performance, it's pretty much even. The graphics difference is also fairly close. In 3DMark, for example, the Bay Trail platform is about 45 percent faster than the S4 Pro chip in the Nexus 7 Mk. II while the gap between Tegra 4 and Bay Trail is only about 10 percent. It's also a back-and-forth between Bay Trail and Tegra 4 in the compute-intense tests. Finally, let's point out the Shield is actively cooled and features honking-large batteries. It's a gaming device, not a tablet. If you can keep a Tegra 4 clocked up at the Shield's levels in a thermally and power-constrained tablet remains to be seen.

What we can conclude from our Bay Trail testing is that 2014 will see x86 finally taking the fight to ARM in tablets in a truly competitive way. The game is far, far from over, but from the looks of it, it's a real ball game now.



Think of Bay Trail as more of an Ivy Bridge Lite, with its 22nm process and microarchitecture that borrows more from Ivy Bridge than Haswell.

NEW vs OLD: BAY TRAIL COMPARED TO CLOVER TRAIL+

	ATOM Z3770	ATOM Z2580
CODE-NAME	BAY TRAIL	CLOVER TRAIL+
PROCESS	22NM	32NM
DIE SIZE	NOT DISCLOSED	65mm²
TRANSISTOR COUNT	NOT DISCLOSED	140 MILLION
CLOCK SPEED	1.4–2.4GHZ	1.3–2GHZ
RAM	LP-DDR3/1067	LP-DDR2/1067
MAX RAM	2GB	2GB
CORES/THREADS	4/4	2/4
L2 CACHE	2MB	1MB
GRAPHICS	INTEL HD GRAPHICS	POWER VR SGX544MP2
MAX RES SUPPORT	2, 560 x 1,600	1,900 x 1,200

CPUs COMPARED

OPERATING SYSTEM SOC	INTEL BAY TRAIL ANDROID 4.2.2 INTEL ATOM Z3770	GOOGLE NEXUS 7 (MK. II) ANDROID 4.3 QUALCOMM SNAPDRAGON S4 PRO	GOOGLE NEXUS 7 (MK. I) ANDROID 4.3 NVIDIA TEGRA 3 T30L	NVIDIA SHIELD ANDROID 4.2.1 NVIDIA TEGRA 4
3DMARK ICE STORM UNLIMITED	15,185	10,659	3,213	16,657
AN3DBENCHXL TOTAL	48,315	37,896	35,291	49,009
GFXBENCH 2.7.2 T-REX HD OFFSCREEN	16	15	3.2	24
GFXBENCH 2.5 EGYPT HD OFFSCREEN	41	40	9.8	65
ANTUTU 4.0.1	36,174	20,510	13,403	40,541
GEEK BENCH 3 SINGLE-CORE	973	579	341	921
GEEK BENCH 3 MULTI-CORE	3,000	1,852	1,115	2,923
MOBILEXPRT	250	152	120	226
MOBILEXPRT APPLY PHOTO EFFECTS (SEC)	30.84	44.25	53.88	36.83
MOBILEXPRT CREATE PHOTO COLLAGES (SEC)	12.2	17.33	22.6	17.97
MOBILEXPRT CREATE SLIDESHOW (SEC)	19	36	45	21
MOBILEXPRT ENCRYPT PERSONAL CONTENT (SEC)	55.58	110.26	121.69	50.69
MOBILEXPRT DETECT FACES TO ORGANIZE PHOTOS (SEC)	7.44	11.88	17.58	6.99
SUNSPIDER 0.9.1 (MS)	625.8	1,215	1,392	534.8
GUIMARK 2 VECTOR CHART TEST HTML5	12.98	5.67	6.49	9.84
GUIMARK 2 BITMAP GAMING TEST HTML5	33.19	14.41	16.19	39.24
GUIMARK 2 PIXEL STROKE HTML5	34.24	22.87	16.47	33.04
GUIMARK 2 TEXT COLUMN TEST HTML5	8.37	5.52	4.66	11.45
VELLAMO HTML5	WNR	1,590	1,366	2,881
VELLAMO METAL	1,120	698	358	1,162

SATA EXPRESS AND NVME

A MUCH FASTER INTERFACE AND PROTOCOL LOOM ON THE HORIZON

LAST YEAR, WE were nudging the limits of what the SATA 6Gbps interface could offer, and now that we're nearing the end of 2013, there's a pileup of SSDs all pushed up against the interface's bandwidth ceiling. The bad news is, this situation is not likely to change much in 2014 because even though APC readers all want faster SSDs, the majority of the market is still using mechanical hard drives, and we're going to need a new interface/connector, a new protocol, and a new command set to really move forward, and all those things will take time to implement. The good news is that the industry is slowing beginning to move in the direction of an all-new storage subsystem, which will jettison both the SATA bus and the AHCI standard in favour of a solution with much more bandwidth. But swapping out connectors and interfaces is no small matter, and unfortunately it will be a few years before we're all rocking something bigger and better.

When this new interface arrives, probably in 2015, it will be called SATA Express (SATAe), as the industry as a whole has decided that PCI Express is the chosen interface for the future of storage due to its scalability and the fact that it's already implemented in modern chipsets. The reason it's called SATA Express is that it's a bridge between the past (SATA) and the future (PCI Express), and will feature an interface that accepts both types of devices. There have been drives that bridge the two interfaces, such as OCZ's RevoDrive3 X2, available for some time, but those drives simply entail standard SATA drives in RAID and plumbed into PCIe as a workaround to the bandwidth limitations. True SATAe will be native to the interface.

Samsung's XS1715 NVMe drive is a hint of things to come, as it can read at a whopping 3GB/s with a capital B.

There are actually early SATA Express–type drives on the market, but they are not 2.5-inch models that you can wedge into your rig. Instead, they are drives like the one featured in the new Mac Pro, which is simply listed as "next-generation PCI Express flash storage." We asked Samsung about its plans for SATA Express drives, and it pointed to the new Mac. Yes, we know it hurts. On the PC tip, Samsung has the XP941, which is a SATA Express drive that is the size of a stick of gum and offers sequential read performance of 1.4GB/s on the PCIe 2.0 interface using the M.2 form factor. All the initial SATA Express drives will use the M.2 form factor, which means SATAe will launch in notebooks first, then desktops.

When SATA Express does arrive on the desktop, it will feature a connector that is compatible with both PCIe drives and SATA drives. It's expected to first appear in Intel's Z97 core-logic chipset when its Broadwell platform debuts, hopefully sometime in 2015. It will likely scale to 8Gbps and then 16Gbps before being phased out for an all-new protocol dubbed Non-Volatile Memory Express (NVMe).

NVMe is designed specifically for flash-based drives in an attempt to free us from the bonds of SATA and AHCI, which were designed for rotating storage. To give you an idea of how bitchin' NVMe is, the AHCI protocol, for example, supports a queue depth of 32 commands, while NVMe supports up to 64,000. Here's another number for you to chew on: Current SATA 6Gbps drives can hit about 85,000 IOPS doing 4K random writes. NVMe drives have demonstrated the ability to deliver 3,000,000 IOPS – though that was with DRAM instead of NAND flash in order to simulate what could happen in the future when flash speeds increase. With a NAND drive connected, it rung up over 700,000 IOPS, which is a staggering increase in performance. So, we'll be sticking with SATA 6Gbps for 2014 on the Intel Z87 and AMD 990FX chipsets, then switching to SATA Express in 2015, then NVMe after that.

HARD DRIVE HAPPENINGS

If you follow the mechanical storage industry like we do, you will have noticed that the majority of the new product announcements over the past year have involved mobile drives, cloud storage, mSATA drives, and things of that nature. The reason for this is the desktop hard drive is quickly becoming a relic of a soon-to-be-forgotten era where people stored files locally. Nowadays, people store their music, email, and even documents in the cloud, so the need for local storage is decreasing while all the growth in the sector is in solid-state and mobile. Given this state of affairs, mechanical hard drive development has slowed to a crawl, with new hard drive announcements arriving about as often as a gift basket from your bank manager. Still, development continues, of course, so we can expect some increases in capacity over the course of the next year, but since any performance gains made by rotating drives are paltry compared to what the cheapest SSD can pull off, the concept of a performance hard drive is already a relic, as well. Proof of this sad fact is that neither Seagate nor Western Digital even list a hard drive's spindle speed anymore, and instead just list the storage capacity, form factor, and amount of cache.

So, what do we have to look forward to on the hard-drive front? Not much, sadly. We already have 4TB, five-platter, 7,200rpm hard drives, which is enough for most people. Seagate has announced that it will deliver a 5TB hard drive in 2014 thanks to a new technology named Shingle Magnetic Recording, which overlays bits of data like shingles on a roof. The company says it expects to be at 20TB by the year 2020.

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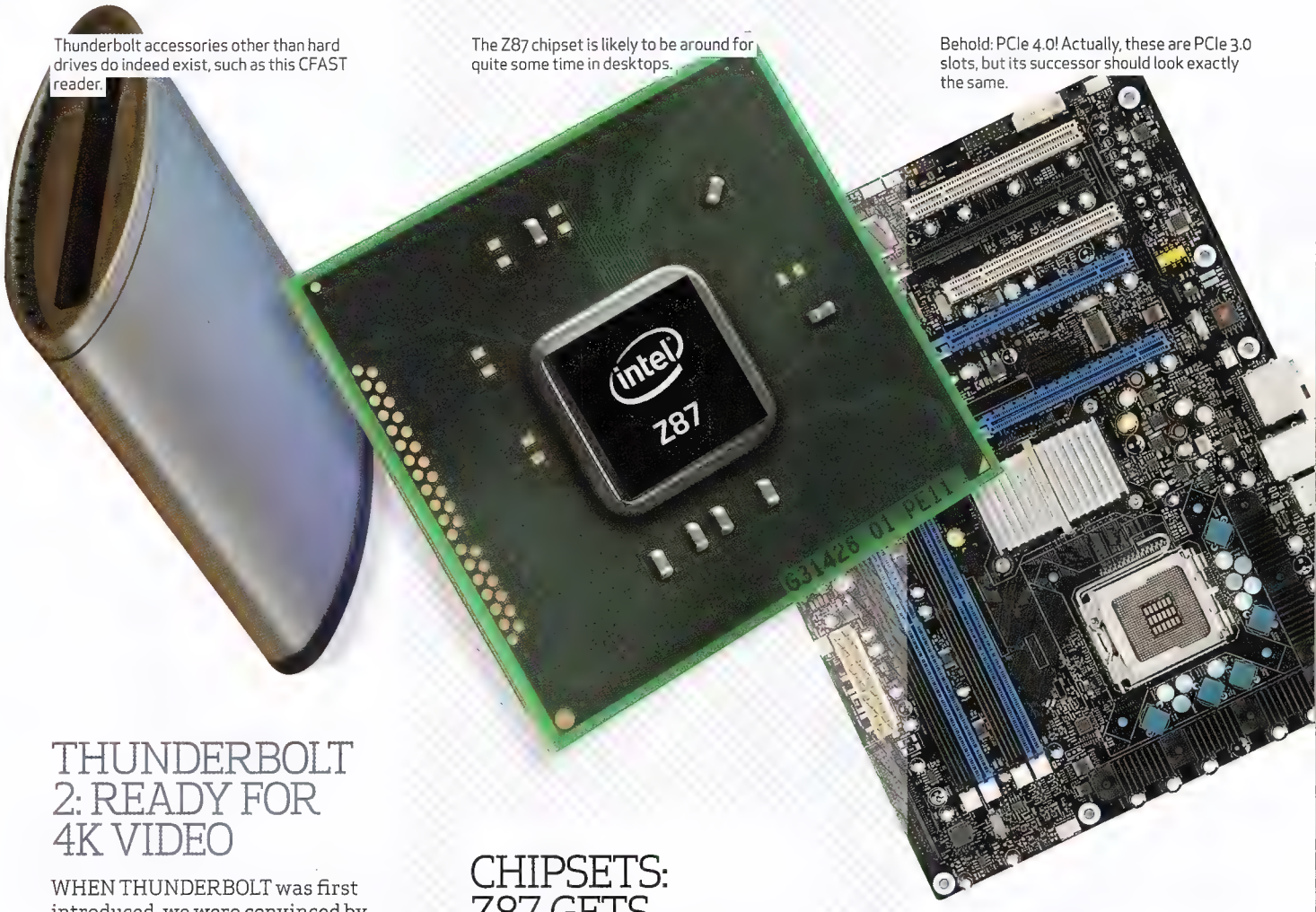


Thunderbolt accessories other than hard drives do indeed exist, such as this CFAST reader.

The Z87 chipset is likely to be around for quite some time in desktops.

Behold: PCIe 4.0! Actually, these are PCIe 3.0 slots, but its successor should look exactly the same.

THUNDERBOLT 2: READY FOR 4K VIDEO

WHEN THUNDERBOLT was first introduced, we were convinced by an analyst that the spec's future was bright. Even though PC OEMs were resistant to the super-powerful-but-pricey peripheral interface, it seemed like with Apple and Intel's support, Tbolt could not fail. Today, we're not so sure where it's headed. Resistance remains among OEMs and PC hardware vendors, and with USB 3.1 on the horizon, it seems likely that Thunderbolt will be another FireWire.

Thunderbolt 2 increases the bandwidth from 10Gb/s in each of its two channels to a single 20Gb/s channel. You're probably wondering how that's so different. Previously, any given peripheral was limited to a single channel, i.e. 10Gb/s. So with video at 4K requiring slightly more than 10Gb/s, a Thunderbolt channel couldn't handle it. Now, Tbolt 2 is capable of streaming uncompressed 4K video.

More importantly: Intel has finally agreed to allow vendors to pump external video into Tbolt, so you can finally expect to see Thunderbolt and Thunderbolt 2 on systems with only discrete graphics controllers. You know, like the people who run Xeons and actually need that kind of high-speed external interface.

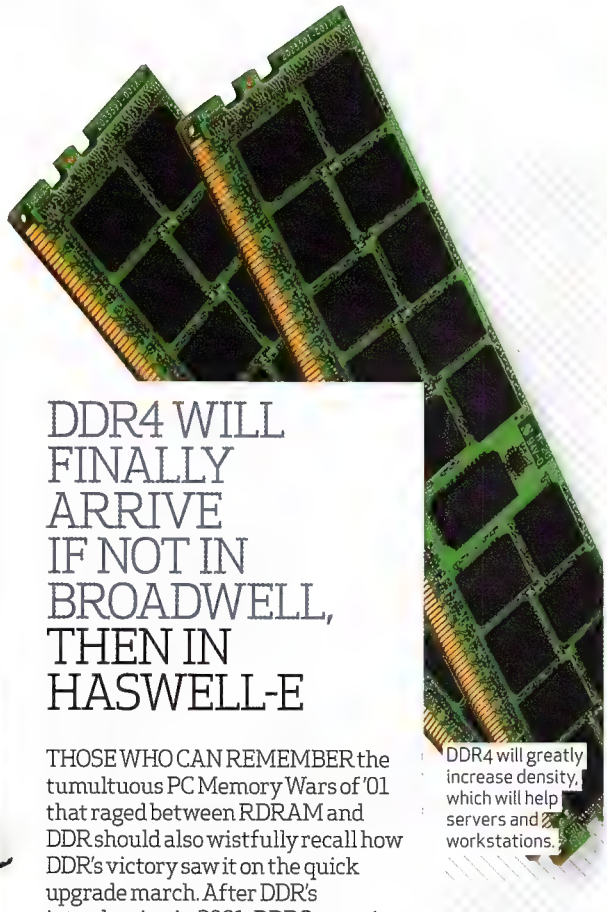
CHIPSETS: Z87 GETS COMFORTABLE

LET'S NOT MINCE WORDS HERE: PC chipsets are going to have a pretty boring stretch for most of next year. With the fresh Z87 chipset here, Intel isn't expected to offer much in chipset-land until the end of next year. That's when the company is expected to ship its replacement for Ivy Bridge-E, called Haswell-E, with the new X99 chipset. Full details of X99 haven't been disclosed but we're guessing the chipset will bring an updated Peripheral Controller Hub, i.e. south bridge, with loads of SATA 6Gbps ports and native USB 3.0 support. DDR4 support will also come on X99 but that's not a function of the chipset, as the memory controller is integrated into the CPU. We'd love to also see 10Gb Ethernet, but, well, that doesn't look to be happening anytime soon. Intel's mobile-focused Broadwell will likely get its own chipset that will have some compatibility with Haswell CPUs, but we're still convinced Broadwell will be mobile-only and come in BGA form. That means Broadwell will likely live only in NUC-style machines, notebooks, and all-in-one PCs.

PCIE 4.0: TRUST US, WE'LL NEED IT

WHEN PEOPLE hear the words PCIe 4.0, they invariably pop off that they see no need for it because PCIe 3.0 has more than enough bandwidth. Now, pretend you're sitting in gridlocked traffic in Sydney peak hour and squawk some more about not needing more bandwidth. You build the lanes before the congestion brings the entire system to a grinding halt, capiche?

With that said, PCIe 4.0 is not a 2014 technology. In fact, we'd be surprised if we saw it in 2015 – even though the spec is expected to be 90 percent done by then. PCIe 4.0 again doubles bandwidth, taking PCIe 3.0's 8Gb/s speeds to 16Gb/s. A x16 PCIe 4.0 slot on a 2015 motherboard could theoretically transfer a whopping 64GB/s. And lest you think the PCI-SIG is ceding everything to Thunderbolt (which supports the PCIe protocols), the group is working on an external PCIe spec and cable called OCuLink, with speeds supporting up to 32Gb/s in each direction.



DDR4 will greatly increase density, which will help servers and workstations.

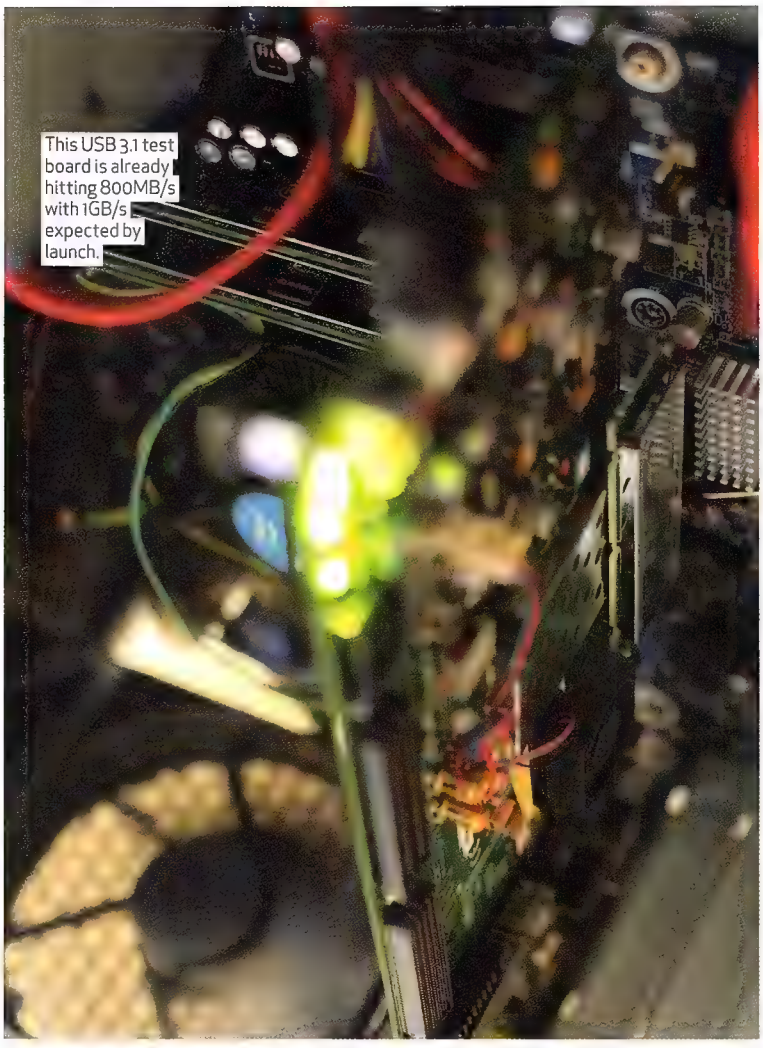
DDR4 WILL FINALLY ARRIVE IF NOT IN BROADWELL, THEN IN HASWELL-E

THOSE WHO CAN REMEMBER the tumultuous PC Memory Wars of '01 that raged between RDRAM and DDR should also wistfully recall how DDR's victory saw it on the quick upgrade march. After DDR's introduction in 2001, DDR2 came in 2004 and DDR3 in 2007. Since then, however, the appetite to upgrade main system RAM hasn't been there. When DDR4 finally comes out next year, we'll have been sitting with DDR3 for seven years.

DDR4 is expected to have support when Intel introduces its mobile-focused Broadwell CPUs next year. We say "expected" because there are leaks that indicate Intel may actually decide to back DDR3 with Broadwell instead.

Even if Broadwell doesn't support DDR4, we expect the new RAM to appear with the Haswell-E that's slated for the end of next year. And yes, we have faith we'll see the new CPU by then. We've actually seen prototypes of the server and desktop versions of Haswell-E, so we know the damned thing exists. What's more, Kingston showed off a server running 192GB of DDR4/2133. The company didn't say what CPU was in the box, but it wasn't hard to deduce it was Haswell-E.

DDR4 promises higher speeds, lower voltage, and greater densities over DDR3. The memory itself has been capable of being produced for more than two years, but its adoption has been stalled given the price premium and incompatibility. Since the memory controllers are directly embedded into the CPUs, Intel and AMD would have to spin new silicon to support the RAM. Both would likely have to support both DDR4 and DDR3 versions because the vast majority of computers will continue to run DDR3 due to cost.



This USB 3.1 test board is already hitting 800MB/s with 1GB/s expected by launch.

USB 3.1 DOUBLES DOWN

10GB/S SPEEDS AND OTHER GOODIES

EXPECT YOUR SuperSpeed connections to get even, um, speedier next year, which is when the USB-IF is predicting the first USB 3.1 devices to emerge. USB 3.1 essentially doubles the speed of USB 3.0 from 5Gb/s to 10Gb/s while offering backward compatibility.

Since native support in Intel and AMD's chipset aren't expected immediately, motherboards and notebooks will instead integrate USB 3.1 discrete chips for support. In press demos, USB 3.1 devices are already hitting speeds in excess of 800MB/s. By the time the tech is available next spring, the USB-IF thinks speeds above 1GB/s should be attainable. Thunderbolt 2 wasn't the only connection being used to stream 4K; USB 3.1 was also demonstrated streaming 4K video — albeit compressed — using a DisplayLink connection.

That's not all. The USB-IF hopes the first devices with Power Delivery support will debut next year. USB Power Delivery devices will support universal charging through a USB port delivering up to 100 watts. In stark contrast to today's maddening array of proprietary power bricks, your next laptop could charge through a standard USB 3.1, USB 3.0, or USB 2.0 connector, much the same way you can charge your phone through any Micro USB plug (well, except for Apple's, of course.)

The USB-IF is also working on a new Media Agnostic USB (MA USB) that combines WiGig, Wi-Fi, and WiMedia Ultra-Wideband radios. MA USB is essentially a reboot of the not-so-popular Certified Wireless USB. MA USB will allow short-range wireless connectivity over everything from the 60GHz spectrum to existing 2.4GHz spectrum — all using the USB protocol.

WINDOWS GOING FORWARD

CONVERGING DATA AND DEVICES

AS AN OPERATING SYSTEM running on somewhere around 90 percent of the world's desktop computers, Microsoft Windows isn't just an 800-pound gorilla. For the overwhelming majority of us, Windows is the computer. Microsoft sold more than 100 million copies of Windows 8 in the first six months of release, and it considers this number below expectations. Perhaps you're one of the holdouts. If so, you're probably wondering if the freshly unveiled Windows 8.1 is worth dipping your toes into, and what the future holds for this OS. And where does the company's $7.2 billion purchase of Nokia's phone division fit into this, if at all?

WHAT 8.1 IS NOT

Microsoft re-introduced a menu-like button in desktop mode, but it only returns you to the Modern interface — which you can already do by pressing the Windows key on your keyboard. But you can still get your own menu button from third parties, such as Start Menu 8 or StartIsBack. Others are just a Google search away. You can also go directly to desktop mode, but Modern retains all of its original functions.

WHAT IT IS

Windows 8.1 has boosted discoverability. The Modern interface's search function can now combine results from your local files, your apps (what some crusty desktop users still refer to as programs), and Bing, Microsoft's competitor to Google. Speaking of apps, Microsoft also says that its app store has been updated for more accurate search results, and 8.1 brings some pre-installed apps. Reading List is like a clipboard on steroids, and Windows 8.1's Photos app is supposed to have smoother editing workflow. Microsoft's SkyDrive cloud storage service is now pre-installed as the system default, and Internet Explorer 11 is also thrown in. Lastly, the update to 8.1 is free, and MS will probably stop selling the base Windows 8.0 version sometime next year.

WINDOWS 9 AND 10

Right now, we have only rumours circulating on the internet, from people apparently outside of Microsoft. A person known only as "WZOR," on the Russian forum **Ru-Board.com**, has been widely reported as the source of Windows leaks for several years and has accumulated a respectable track record for accuracy. This fellow claims that we'll see Windows 9 sometime in 2014, and that it's allegedly returning to the Aero interface for desktop mode (but will presumably retain Modern alongside it).

It's unusual to have even this much information about an upcoming OS from Microsoft so far ahead of time. So there's still time for the basic elements to change, assuming that we understand them correctly. We even have some tidbits about Windows 10: It's apparently going to be cloud-oriented for apps as well as data, *à la* Google Docs. As computing becomes an increasingly mobile experience, it makes sense to store data at a location where it's all synced and accessible from a single service. But maintaining that kind of service costs money, eventually more than a one-time purchase of an operating system would support, even when multiplied by a hundred million purchases. A unified mobile future seems to call for a subscription-based OS — something Microsoft is already setting precedent for with Office 365.

GETTING MOBILE

That's presumably where Microsoft's purchase of Nokia's phone division fits in. Apple's iPhone experience is all under one roof, while Google has juggled dozens of different partners with varying degrees of success. Microsoft wants the minimal barriers that Apple benefits from, and it has the deep war chest for it. Rob Enderle, founder and chief analyst of Enderle Group, tells us, "The firm gives them a much more solid position as a European company, very important if you want the European Commission to see you more favourably. It assures [Microsoft] can hold on to the phone beachhead [it has] established, and it corrects inefficiencies between Microsoft and Nokia that were slowing advancement and hurting their ability to execute globally."

Overall, Microsoft looks like it's betting that the bulk of its desktop platform will become a mobile, always-connected future. The form factor of workstations and servers probably will not change much for the foreseeable future — but it's clear Microsoft is preparing for a future where the desktop looks like it will dramatically, shrink or be more frequently replaced with a laptop. ■

In Windows 8.1, the Modern interface allows higher tile density and the ability to select tiles by group.

DISC CONTENTS

Issue 397 Christmas 2013

Every issue, *APC* brings you a selection of exclusive full-version programs, entirely free. Here's what you'll find this month:

PROTECT YOUR DATA

Abelssoft Cryptbox 2013 LitePlus lets you encrypt personal data easily

Cryptbox 2013 lets you encrypt personal data easily. CryptBox creates Safes, which look like normal drives and which can be filled with data like you are used to in Windows. You don't have to be an encryption expert to use the program: CryptBox's wizards guide you step by step to your own Safe and help you by choosing the right size, encryption algorithm and password for it. Plus, CryptBox encrypts your data with the AES-256 algorithm, which is approved for top secret information in the USA, and can be used to encrypt whole drives, portable drives, and more.

SYSTEM REQUIREMENTS

- A CD/DVD-ROM reader or burner.
- The *APC* disc is designed for use with up-to-date browsers (for example, Internet Explorer, Chrome, Firefox).
- The interface included on the *APC* disc requires a JavaScript-enabled browser.
- An internet connection may be required for online registration of software before use.
- The software packages on the *APC* disc have different system requirements. Software is included on the disc for Windows XP, Vista, 7 and 8.

BEFORE INSTALLING

- Check the disc using a virus scanner complete with the latest antivirus data updates. The disc was checked before burning, but new viruses are being discovered all the time.
- Back up any important system and data files. It is not recommended that the software contained on these discs be installed on production machines.
- If you have any questions regarding the use of the *APC* disc, click the 'Help' button at the top of the screen.

USING THE DISC

Insert the disc into a CD/DVD-ROM reader or burner and your web browser should automatically load the interface. If not, launch your web browser and load the default.html file from the root directory of the disc.

HELP

If you have any problems with the *APC* disc, please visit *www.apcmag.com/disc.htm*.
APC provides no technical support for this disc or any software provided on it.

FULL VERSION WORTH $15!

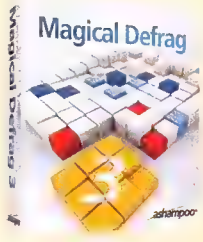
RECLAIM YOUR STORAGE

Analyse and optimise your storage with 1-abc.net Drive Space Organizer 5

» Do you constantly find yourself running out of space on your PC and external hard drives? Drive Space Organizer is here to help. The program analyses your computer and locates your biggest files and the folders containing the most disk-space-consuming data to help you recover your drive space (sometimes from places you hadn't even heard about before). Drive Space Organizer 5 makes storage management easy, letting you select which data measurements are displayed (kilobytes, megabytes, gigabytes etc) and offering percentage bars for the five biggest data items in each folder, so you can quickly and easily see what's taking up your precious hard drive space.

FULL VERSION WORTH $14!

SPEED UP YOUR PC



Defrag your hard drive with Ashampoo Magical Defrag 3

» When was the last time you defragmented your hard drive? Can't quite remember? Then join the ranks of many users that shy away from the time-consuming defragmentation of their hard disks. Over time, hard drives get fragmented due to half-hearted maintenance, resulting in a significantly measurable performance loss. This is where Ashampoo Magical Defrag 3 steps in. The program runs as a background service and defragments your hard drive only when the computer is idle, hence enabling you to follow your everyday work routine without any distraction.

PRODUCTIVITY ESSENTIALS

10 must-have apps in our productivity & office toolkit.

Please note, due to a scheduling mix-up, this month's disc (issue #397) is incorrectly labelled 'January 2014' instead of 'Christmas 2013'. Sorry for the confusion, folks! We'll be back to regular programming next issue.

DISCLAIMER Future Publishing is not the licensor of the software and documentation on the enclosed disc (the 'software'). Rather, Future is merely a distributor of the software, and your use of the software is subject to any accompanying third party licence terms. You must carefully read and comply with any such third party licence terms, together with all instructions and README files that come with the software. Accordingly, to the maximum extent permitted by law, all software is provided by Future 'as is' and without warranty either express or implied, and Future will not be liable for any damage that you may incur as a result of using the enclosed disc. You should back up any important system and data files before using the enclosed disc. We recommend that you do not use the enclosed disc on a production machine. Nothing in this disclaimer excludes any warranty that may be implied by statute, which may include the Trade Practices Act. Notwithstanding the foregoing, if the enclosed disc is faulty or damaged, we will replace them for you. While we have taken all reasonable steps to check the enclosed disc for viruses, we cannot guarantee that it is free from viruses or other harmful code and you should check each disc using a virus scanner complete with the latest antivirus updates before use.

CLOUDY WITH A CHANCE OF STORAGE

15 ONLINE STORAGE SERVICES COMPARED

The convenience of cloud storage is undeniable: your data and media at your fingertips from any internet-connected device—what's not to like? And there's certainly no shortage of options to choose from, most of which are totally free up to a certain capacity. The trick is deciding which cloud service to use. After all, there are notable differences between them. Some are ideal for security mavens who want to preserve their anonymity (and the anonymity of their data). Others are better for folks just looking for a massive dumping ground for a ton of data. And still others are geared toward those keen on sharing all sorts of files with their friends and colleagues. In this roundup, we'll break it all down for you and identify the strongest cloud storage services. We'll also show you how to encrypt files that you store online and how to combine multiple cloud-storage accounts into one unified pot.

AMAZON CLOUD DRIVE

The free iteration of Amazon's Cloud Drive nets you 5GB total of space to work with, but there's a bit of a catch: Don't go expecting to upload huge files to the service, as you're capped to a maximum of 2GB per file. If you need more overall storage, you'll be ponying up in various increments up to and including US$10 a year for 20GB of space, US$50 a year for 100GB, and a whopping US$500 a year for 1TB of cloud storage (oof!).

On our benchmark — a 132MB transfer of 24 total files — Amazon clocked in at 3:15 (min:sec). That's not the speediest of upload times among all the cloud services we tested; worse, the files you upload to Amazon don't appear to be encrypted once they hit the server.

Amazon Cloud Drive operates as a simple downloadable app for your PC that syncs a folder's worth of files to your online storage, in addition to a web-based tool for managing your files in the cloud. The latter comes with a ho-hum player that lets you view your pics, listen to your tunes, or watch your movies — it ain't pretty, but it works. Annoyingly, Amazon only lets you share a single file at a time with friends via pre-generated URLs.

www.amazon.com

Amazon's Cloud Drive presents a pleasing list of your files in its online app, though we wish it was more integrated with the company's other cloud storage offerings.

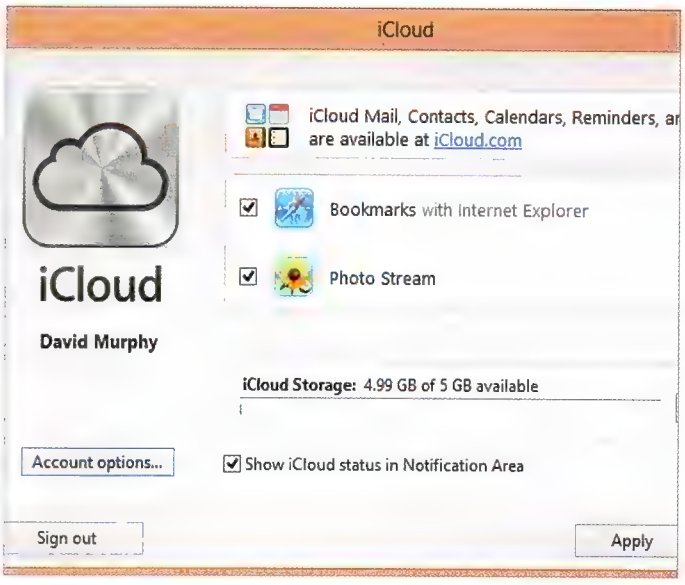
APPLE ICLOUD

Yes, Apple's iCloud is technically a cloud storage service — and then some, once you factor in the service's ability to synchronise your contacts, calendars, notes, and more across your various iOS-friendly devices.

However, if you're using a PC — and just a PC — then you really have no need whatsoever to install Apple's meagre iCloud app. You can only really sync files from your iOS devices' Photo Streams to your PC (or, conversely, photos from a specified PC folder to your iPad or iPhone). Otherwise, it's not like Apple's giving you a folder for dumping files into that will somehow synchronise with other PCs you've installed the iCloud app onto.

If you do own multiple Apple devices, iCloud's feature set (and device integration) is pretty awesome in most ways, save for its price — beyond the 5GB you get for free, there is a yearly fee of US$20 for an extra 10GB of storage, US$40 for 20GB, or US$100 for 50GB. To Apple's credit, the company doesn't count iTunes movies and music against your total storage quota. And the core offerings — mail, contacts, calendar, and notes synchronisation — should hardly chip away at your free 5GB. Additionally, Apple stores your information using 128-bit AES encryption at minimum.

www.apple.com



You can't really do much with iCloud if you're not an Apple aficionado.

BITCASA

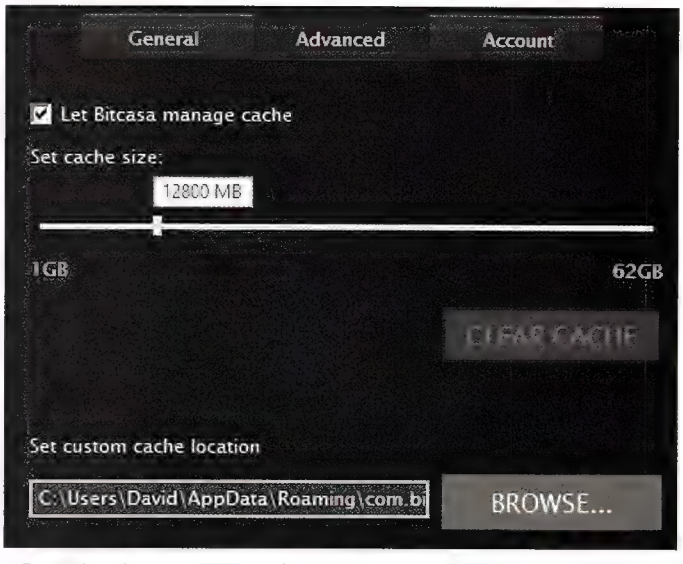
This desktop- and web-based cloud service delivers a pretty hefty amount of free storage (20GB) in addition to our favourite caveat: no restrictions whatsoever on the file sizes you want to throw into your online pool. And if you need more room, Bitcasa offers annual rates of US$99 for 1TB; US$499 for 5TB and US$999 for infinite capacity.

Bitcasa dumps an Infinite Drive onto your system as a new drive letter. Whatever you toss in heads up to the cloud but, unlike Bitcasa's peers, the files aren't automatically mirrored on your local hard drive. A built-in caching mechanism ensures that you still have access to your most-used files when you're offline, and you can adjust just how big your cache is via the app.

As for the app's performance, it took us a mere 19 seconds to send 132MB of files up — a killer transfer time.

You can mirror folders on your hard drive if you want more standard cloud-sync functionality, and your data always remains protected on Bitcasa's servers with 256-bit AES encryption. Sharing your files is as easy as viewing them; you can watch movies, listen to music, or view your stored pictures using Bitcasa's web interface.

www.bitcasa.com



Bitcasa's cache is a critical part of its offline functionality, and we're glad for it.

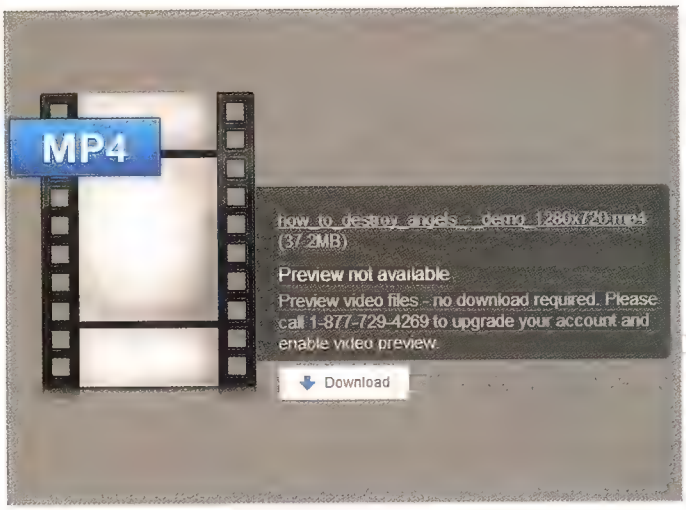
BOX

Ten free gigabytes of storage await those who sign up for the free version of Box. However, you're limited to storing files no larger than 250MB each on the service — practically a sneeze in the cloud-storage world. Adding more oomph to your online offering incurs a monthly fee of US$5 for 100GB on a Starter plan. Doing so bumps you up to a file size limit of 2GB each. There's also a Business plan for US$15 per month for 1000GB and a 5GB file size limit.

Box offers four different apps for getting your PC to play with its cloud storage; it seems a bit of an overkill to have users piecemeal together the functionality they prefer. We couldn't get the Box for Office app to play with our copy of Office 2013, and the standard, folder-synchronising Box Sync app took 3:51 (min:sec) on our transfer test — that's quite lengthy for a single app.

There's no way to view media files you send to Box via its web interface; the service is designed for adding, editing, and sharing documents and text. To that end, we do enjoy how the Box Edit app allows you to start new files and edit them using the office apps on your local desktop, before they're automatically saved up to the cloud when you're done.

www.box.com


MP4
how_to_destroy_angels_-_demo_1280x720.mp4
(37.2MB)
Preview not available
Preview video files - no download required. Please call 1-877-729-4269 to upgrade your account and enable video preview.
Download

For some inexplicable reason, Box has decided to make simple media streaming a paid-for, add-on service.

CUBBY

This no-nonsense cloud app — desktop and web — offers up 5GB of free storage with a single file-size limit of 2GB. Adding more storage will set you back anywhere from US$3.99 per month for 100GB to US$39.90 per month for a full terabyte, but Cubby demands that you buy a year's worth of capacity up front. (In other words, you're locked in.)

To sync your files with the cloud, you can drag them into a new My Cubby folder the app creates, or you can right-click existing folders within your drive's hierarchy to add them to the synchronisation list — a pleasant feature for those who don't want to move data around. Cubby protects your files with AES 256-bit encryption on its end, but the speeds of the synchronisation leave a little to be desired. The service clocked in at 3:46 (min:sec) to shoot our 132MB batch of test files up into the cloud.

Sharing your stored files with others is as easy as sending a provided link to files or a folder to your friends. Cubby also incorporates media playback and version tracking into its web app, automatically deleting old versions of your files as you start to fill up space.

www.cubby.com

cubby
Why Cubby? How It Works Features Pricing Security Enterprise
Sync, share and store. Securely.
Now individuals, teams and enterprises can share files with the simplicity users demand and manageability IT needs. It's productivity paired with peace of mind.
Get started
Work the way you want.
Cubby allows individuals, teams and entire workplaces to easily and securely work together, anywhere. Your files are always where you need them – stored in the cloud for anywhere access, shared with others publicly or privately, or even directly synced between your devices without using the cloud. Now you're free to work when, where and how you want, with the peace of mind that all business information is safe and sound.

Cubby is simple, quick, and easy to use, and you don't even have to change up your existing folder structure if you don't want to.

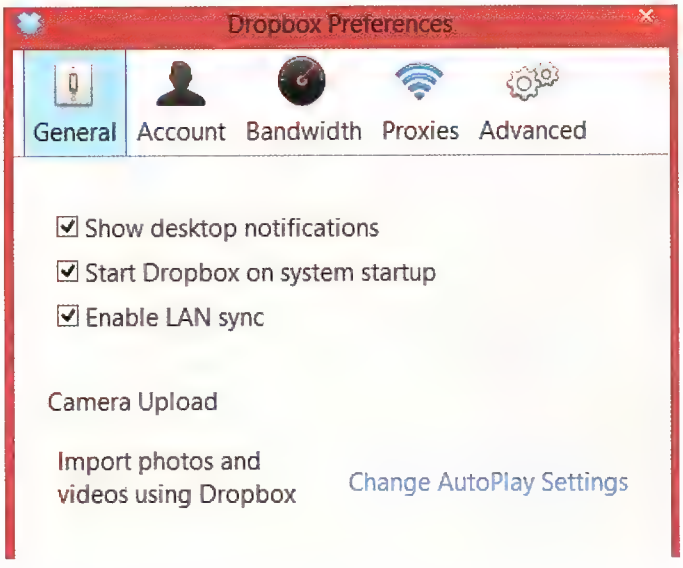
DROPBOX

Dropbox gives you a total of 2GB to start with; additional storage can be had for a not-so-insignificant annual fee of US$99 for 100GB, US$199 for 200GB, or US$499 for 500GB. Adding version-tracking to your Dropbox tacks on another US$39 annually.

Dropbox stashes a single, simple folder onto your hard drive (which you can change, if you prefer). Anything you throw into this folder gets synchronised into the cloud and protected with AES 256-bit encryption. You can modify how much bandwidth you want the app to eat up when it's uploading and downloading, and even selectively sync certain folders on certain computers. An added LAN sync feature speeds up the process by copying files from your other Dropbox-friendly, networked systems instead of pulling them from the cloud — although it only took Dropbox a mere 7 seconds to sync up our 132MB file test.

Sharing folders and files with others is as easy as copying a link that Dropbox provides, but your friends will have to have Dropbox accounts if you want to collaborate within a single folder that's shared among all. The Dropbox web app seamlessly lets you view your photos, rock out to your music, and watch your movies directly in your browser.

www.dropbox.com



LAN sync has saved us so much file-syncing time on our home network, it's almost impossible to measure.

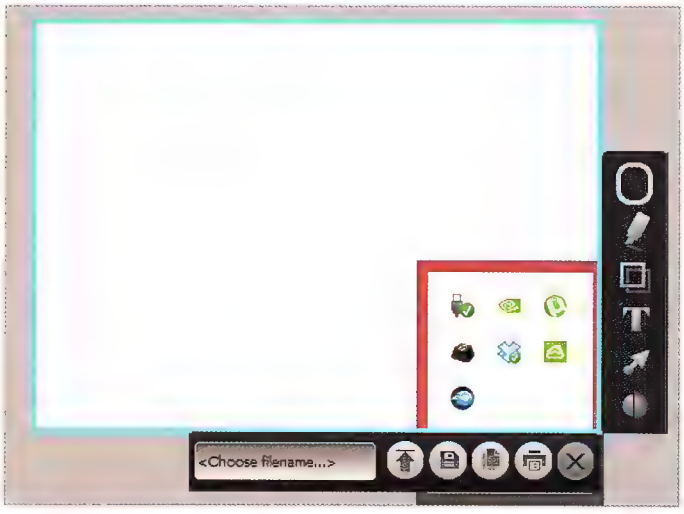
MEDIAFIRE

The desktop app for MediaFire is a bit worthless. Its primary purpose is to provide you with a means for copying files (one at a time) to the service's online cloud storage. Even then, MediaFire is fussy: At one point, we thought we were deleting and uploading fresh sets of files, but the service was instead keeping triplicate copies of our benchmark test. The only redeeming quality of MediaFire's boring desktop app is how it lets you take screenshots of your PC and upload them directly to your cloud storage, but that won't appeal to most people.

Our test file transfer took a whopping 8:40 (min:sec) to upload. Manipulating these files via MediaFire's web interface felt sluggish, and the online storage itself is a bit slow to refresh with newly uploaded files. A built-in media player lets you listen to music and watch videos, but shrinks the latter down to a fixed size — so much for our 720p video.

MediaFire does offer a generous free capacity of 10GB, but restricts your uploads to 200MB per file unless you pony up for a paid version of the service (US$4.99 monthly for 100GB and US$49.99 monthly for 1TB of storage).

www.mediafire.com



We're not exactly sure why a cloud storage app needs a semi-comprehensive screenshot feature, but it's there nevertheless!

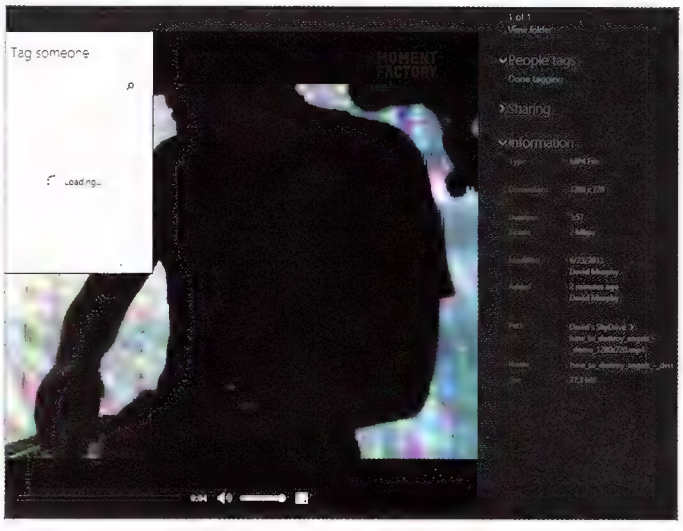
MICROSOFT SKYDRIVE

Ah, SkyDrive. If you're using Windows 8, you'll probably have noticed that access to the SkyDrive cloud is baked into the OS by default. It's also a downloadable app for the more traditional "sync files in a folder to the cloud" kind of access — which we greatly prefer.

The free iteration of SkyDrive gives you 7GB to play with, but your files are limited to a maximum size of 2GB each. Bumping up your storage costs US$10 a year for 20GB, US$25 for 50GB, or US$50 for 100GB. There's no additional encryption for anything you slap into SkyDrive, and there's certainly not a great deal of speed for files synchronised via the desktop app. Our 132MB transfer test clocked in at 3:56.

We do, however, love SkyDrive's Fetch feature. If you set up the desktop app correctly, you can actually tap into your computer from afar and access any file on any drive within your system. It's a crazy-convenient way to access files without having to put them into SkyDrive in the first place, and you can stream videos or view pictures from the SkyDrive web app itself. (No audio files, though; sorry!)

www.skydrive.com



SkyDrive's online media player (no audio!) is one of the best we've seen of the major cloud service providers; you can even tag your friends.

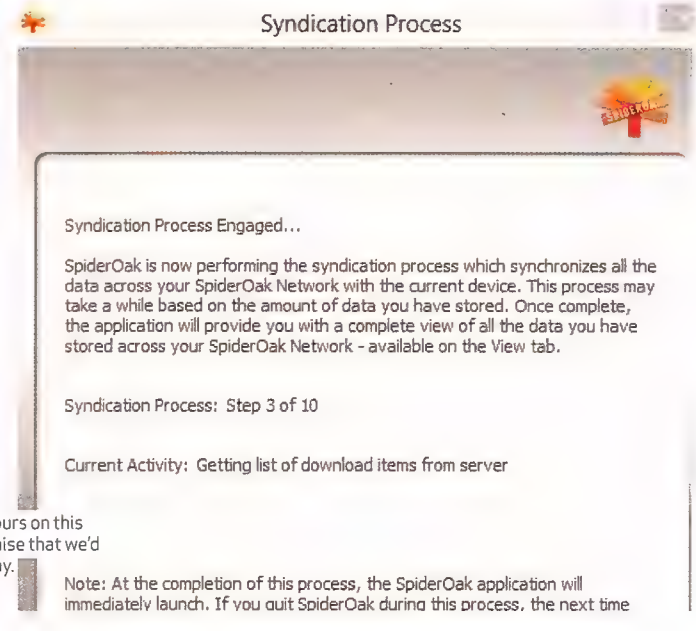
SPIDEROAK

We wish we had more to report about this allegedly super-secure cloud storage app. However, it's so secure, that it didn't let us into the cloud service no matter how much we tried to run through the fairly simple-seeming account setup process.

The major boon to SpiderOak is that it's designed as a "zero-knowledge system." The company has no idea what you share to the service; a benefit to user anonymity unless you forget your password, forever locking your ability to access the ultra-secret data you've stored.

Part of the process involved with generating encryption keys for SpiderOak is that you must run the associated desktop app before you can access your cloud storage for the first time. Try as we might — and we let it run overnight, even — our app just sat at the third step of SpiderOak's setup process. That's supposed to be the part where the app downloads your account information from SpiderOak's servers; in our setup, it was the Achilles' heel that turned our feeble attempt at accessing cloud storage into a bit of rain. Don't waste your time with this one.

www.spideroak.com


Syndication Process
Syndication Process Engaged...
SpiderOak is now performing the syndication process which synchronizes all the data across your SpiderOak Network with the current device. This process may take a while based on the amount of data you have stored. Once complete, the application will provide you with a complete view of all the data you have stored across your SpiderOak Network - available on the View tab.
Syndication Process: Step 3 of 10
Current Activity: Getting list of download items from server
Note: At the completion of this process, the SpiderOak application will immediately launch. If you quit SpiderOak during this process, the next time

Our computer spent countless hours on this screen, taunting us with the promise that we'd be able to use SpiderOak someday.

SUGARSYNC

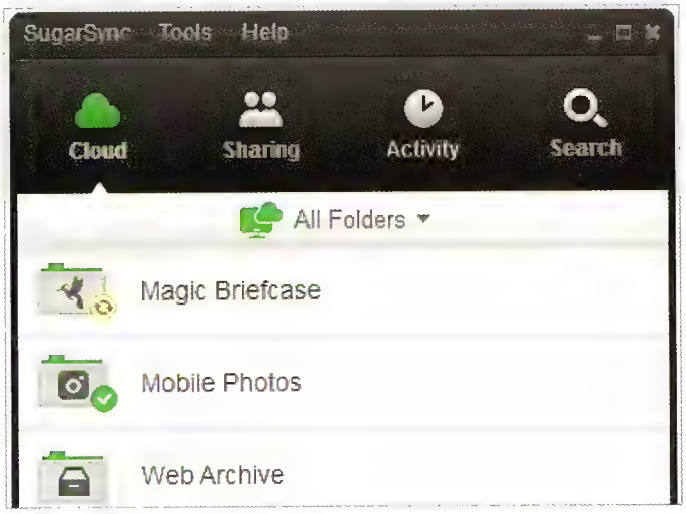
The free iteration of SugarSync is a little bit buried on the cloud service's web site, but signing up nets you five free gigabytes of storage with no limit to the size of files you can place within your online cloud. Additional storage isn't cheap: US$74 per year for 60GB, US$99 for 100GB, US$249 for 250GB.

Installing the desktop app slaps a new SugarSync Drive into Windows Explorer, with three folders to play with: Magic Briefcase, Mobile Photos, and Web Archive. The first is your general, speedy dumping ground — it took all of seven seconds for SugarSync to upload our 132MB batch of test files.

The second is where mobile pictures you take will end up if you enable AutoSync. The third is a cloud-only directory whose contents don't eat up actual space on your hard drive.

SugarSync's web app holds up to five versions of the files you've synchronised into the cloud. Sharing and downloading zipped copies of your folders is super easy; viewing videos or listening to music is not, as SugarSync doesn't come with a web-based player for your media. All of your files are, however, protected with 256-bit AES encryption within SugarSync itself.

www.sugarsync.com



We appreciate SugarSync's hybrid approach: synchronisation and cloud-only storage.

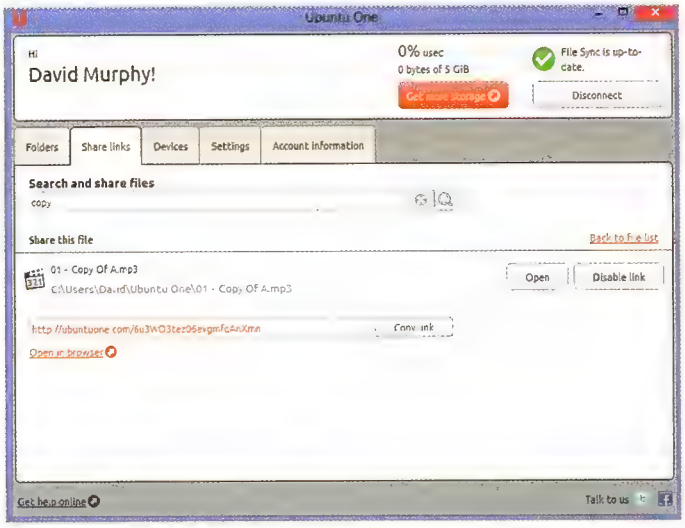
UBUNTU ONE

Yes, even the Linux folk have their own cloud service. Technically, you do as well, given that it's accessible via a downloadable PC app or web-based interface. Developer Canonical grants users 5GB of free storage, with a 5TB limit on the size of individual files you can upload to Ubuntu One. Additional storage costs US$29 per year for every 20GB you want to add to your cloud; tapping into the service's music-steaming companion app tacks a US$4 monthly cost onto the bill.

Canonical might want to work on the speeds of Ubuntu One's desktop app. At about nine minutes into a simple 2.1MB file transfer (yes, that small) we decided to give up, lest our full benchmark test start to rival 24 Hours of Le Mans. What good is a cloud service that takes so long to handle simple file uploads?

Selecting new folders to synchronise to the cloud, as well as sharing them, is just a few mouse clicks away within Ubuntu One's intuitive desktop app. Even if you get your media files uploaded before the next millennium, however, know that Ubuntu One comes with no way to watch movies or listen to music via its web interface. U-bummer.

www.one.ubuntu.com



Sharing files via Ubuntu One is a pain-free process; uploading them, not so much.

TRESORIT

Don't get confused; a "tresor" in Tresorit terminology simply refers to a cloud-synchronised folder. The service's handy downloadable app helps you create new tresors and convert existing folders on your hard drives to tresors, which you can then share with others by tossing an email their way via the app itself.

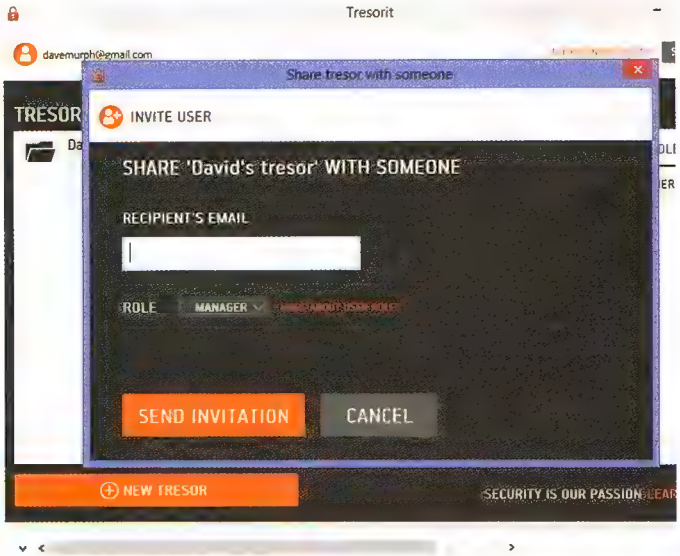
Unless they also install Tresorit, however, they can't access what you've sent them.

Tresorit works decently as a single-user cloud backup system, although it's a bit on the slow side — it took 4:09 (min:sec) for our test files to transfer over, and the Tresorit app doesn't give you any status indication at all as to how many files you have left to upload or even the speed at which they're zooming along.

There's also no web-based version of Tresorit for you to use to tap into your cloud storage.

While you get 5GB to play around with for free, you're limited by a 500MB file size cap and only 20 tresors. Upgrade to the US$12.99 per month plan and you'll get 100GB of storage with each file tapping out at a much more reasonable 2GB; and an unlimted number of tresors to use.

www.tresorit.com



Unfortunately, only Tresorit users can be granted access to your files, limiting the app's overall potential.

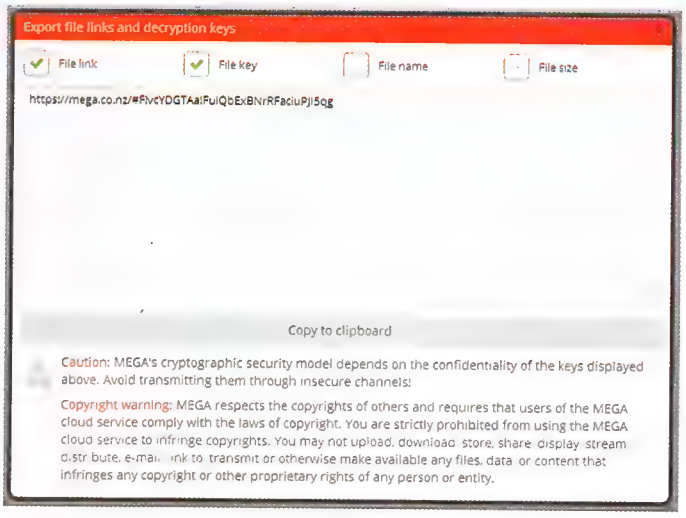
MEGA

Like MediaFire, mega is just an online dumping ground for your files; it doesn't even offer a downloadable app to make it easier. However, Mega is the Fort Knox of file uploaders, using AES 128-bit encryption alongside 2048-bit RSA keys to maintain the anonymity of files both stored on and shared via the service. (Just don't lose your password, or you're stuck.)

A free sign-up gets you 50GB of space with absolutely no restrictions on the size of files you'd like to upload to the service. Adding more space costs annual fees—and it's in Euros: €99 for 500GB, €199 for 2TB, and €299 for a whopping 4TB of storage. Transferring files to fill your massive amounts of space might take a bit of time, however. Mega took 4:02 (min:sec) to upload 132MB. If you want, you can set a speed limit for your uploads to conserve bandwidth, and you can even have Mega skip files in a batch if you've previously uploaded them.

Sharing files is as easy as right-clicking a file or folder, selecting 'Get Link', and sending along the encrypted link to anyone who needs your files. You can also just send the link sans encrypted key, if you want to post something public and have certain people contact you for the final bit they need to access the file.

www.mega.co.nz


Export file links and decryption keys
File link
File key
File name
File size
https://mega.co.nz/#FlvcYDGTAaIFuiQbExBNrRFaciuPJi5qg
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Even Mega's sharing aspect is driven by its hyper-awareness toward security; we approve.

ENCRYPT THYSELF: BEEF UP YOUR FILE SECURITY WITH BOXCRYPTOR

Sure, a number of cloud-storage providers offer powerful encryption on their end, designed to give you a little peace of mind by preventing the very providers hosting your files from knowing their exact contents. But is that really the case? Dropbox, for example, says it offers 256-bit encryption, but it's highly unlikely the service encrypts your files locally before passing on the indeterminate 0s and 1s to its servers.

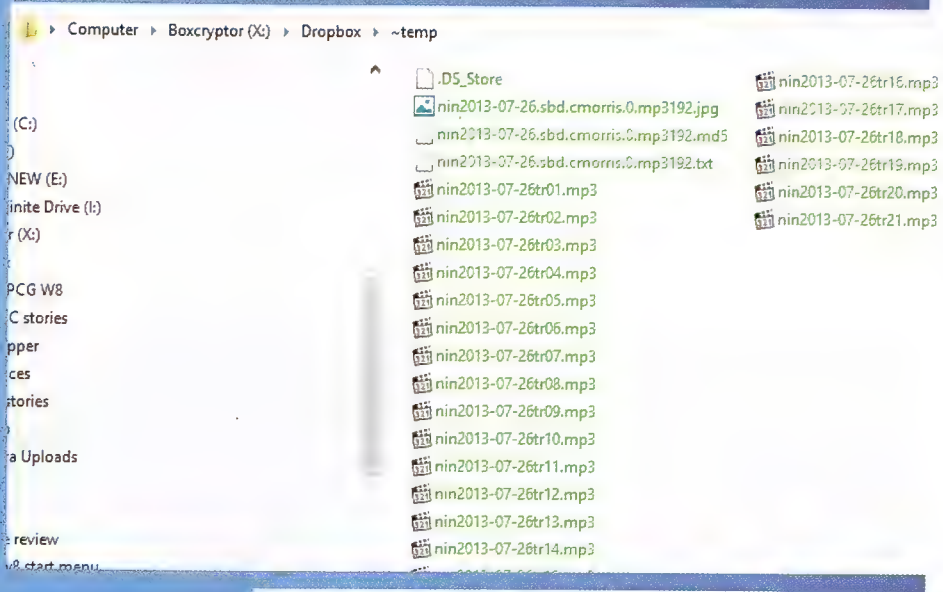
In other words, what good is encryption if a cloud storage provider knows the key? That's where a free app like Boxcryptor (*www.boxcryptor.com*) comes into play. Install the app and set a password — and make sure you don't forget it because, if you do, you'll have no way to decrypt the files you encrypt.

Like most cloud-storage apps, Boxcryptor creates a new drive letter within Windows Explorer. Only, instead of listing your files and folders, the Boxcryptor volume lists the various other cloud service apps you have installed on your system — like Dropbox, for example.

Stick with us.

When you go to view these services within the Boxcryptor volume, you'll be staring at the standard synchronised folder you're used to looking at. Only, now, you can use Boxcryptor to encrypt files you've already synchronised — or, one step better, create a new encrypted folder whose contents is automatically encrypted by the app prior to being synchronised with whatever cloud provider you prefer.

Why do we like this method better than, say, TrueCrypt? It's more seamless and drag-and-droppable, unlike TrueCrypt, which requires you to unmount your entire encrypted volume for the synchronisation process to occur — which can get a bit annoying.



Boxcryptor lets you know that your files and folders are encrypted by displaying their names in a lovely shade of green.

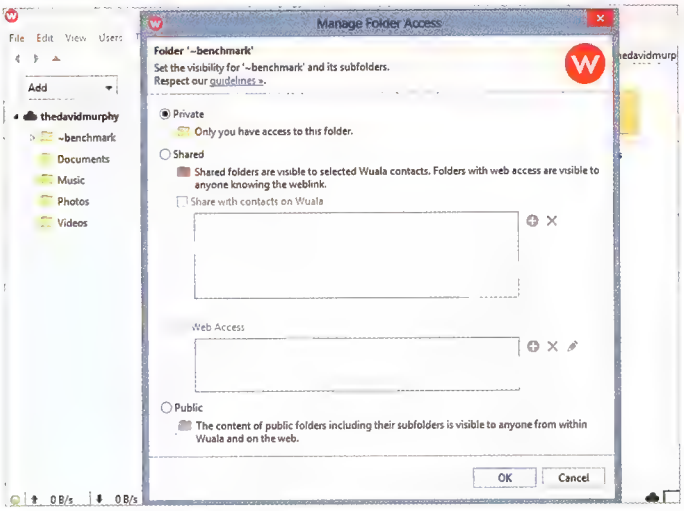
WUALA

LACIE IS BIG on security, offering up AES 256-bit encryption for any file you store on its Wuala cloud service (and going to great lengths to let you know that, no, they aren't peeking at your files). You get 5GB free to start with on Wuala, and an individual file-size limit of 40GB. More storage starts at €2.99 monthly for 20GB and caps out at a mighty 2TB for an annual fee of a mere €1,799.

Like Tresorit, there's no web-based Wuala interface for you to use (save for when you're sharing files or folders with others via the app's cleverly named Secret Web-links). You can synchronise your files to the cloud simply by dragging-and-dropping them in the new W: share drive that the app creates. And Wuala's speedy, too: It took the app just 26 seconds to sync up our 132MB benchmark files.

If you don't feel like dragging-and-dropping, you can also have Wuala synchronise the contents of folders on your hard drives to new folders within Wuala. Popping offline still allows you access to files you've recently downloaded, but it's possible you won't be able to access your entire cloud setup.

www.wuala.com


Manage Folder Access
Folder '~benchmark'
Set the visibility for '~benchmark' and its subfolders.
Respect our guidelines ».
Private
Only you have access to this folder.
Shared
Shared folders are visible to selected Wuala contacts. Folders with web access are visible to anyone knowing the weblink.
Share with contacts on Wuala
Web Access
Public
The content of public folders including their subfolders is visible to anyone from within Wuala and on the web.
OK
Cancel
thedavidmurphy
~benchmark
Documents
Music
Photos
Videos

Wuala allows you to fine-tune your file sharing, so long as your friends are also Wuala users.

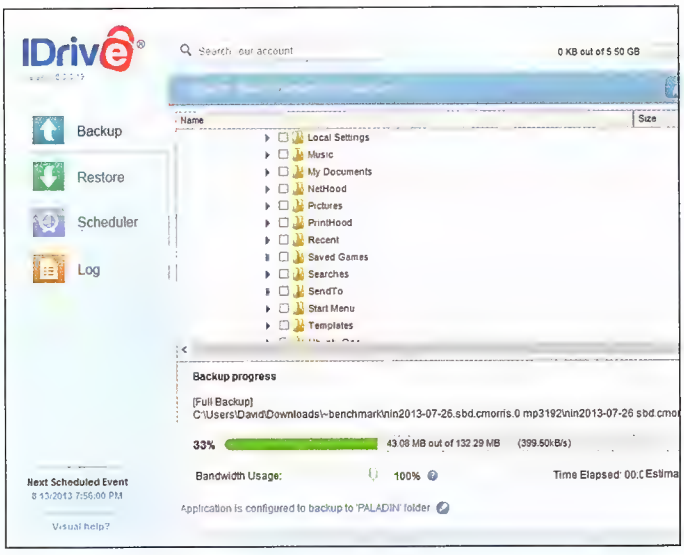
IDRIVE

Though it certainly uses the cloud, iDrive operates more as a backup-and-restore app than a true cloud synchronisation app like so many of its aforementioned peers — or distant cousins. First, the details: You get 5GB of free storage when you sign up, capped at a maximum file-size limit of 10GB each. Adding more storage costs US$49.50 for 150GB, US$149.50 for 500GB, and US$299.50 for 1TB, per year.

Selecting files and folders to back up to your iDrive can be a bit cumbersome via the desktop app, and sending files to cyberspace isn't the speediest of routines. We clocked a total transfer time of 2:48 (min:sec) for our benchmark files; you'll spend far more than that clicking through iDrive's interface when deciding what you want to back up.

iDrive does allow you to share backed-up files with others using randomised links; you can also access your files via iDrive's web app and listen to your music, although there's no provision for watching videos. We like how you can remotely log into your iDrive on a PC via the web to change your to-be-backed-up folders. It's as convenient as iDrive's built-in AES 256-bit encryption is stress-reducing when it comes to keeping your data secure.

www.idrive.com



iDrive's Archive Cleanup will automatically delete files on your cloud storage when they no longer exist on your hard drive — a beautiful backup feature.

The cloud-storage standouts: a summary

As you can see, cloud storage apps tend to pick and choose from a wide assortment of potential features and, unfortunately, a wide range of speeds. It's hard to find a perfect diamond, but we were most pleased by the luster of one cloud app in particular: Bitcasa. It's fast, encrypted, offers more storage than most services for the low, low cost of nothing, and gives you access to an unlimited total capacity for a price that would net you considerably less on other cloud services.

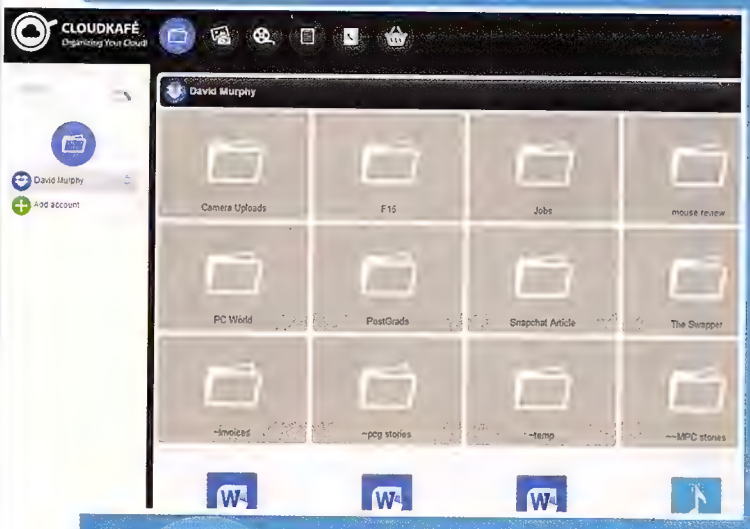
If you care more about security than speed, Mega's your ticket. You don't get a downloadable app with which to synchronise to its servers, but you do get a ton of storage with an almost obsessive focus on security and encryption through all stages of the uploading (and sharing) process. Even Mega's owners seem quite confident of the service's capabilities, offering up cash rewards (up to €10,000!) for anyone who can expose vulnerabilities that might otherwise open up a user's files to pilfering.

Though we weren't keen on Box as a general cloud service, we have to tip our hat to its functionality as an office-themed cloud app. It's not the place where we'd want to stash our critical files, movies, music, or any of that, but the service's tie-ins to Office apps (or Google Docs!) alongside its role-based sharing capabilities make Box an ideal choice for those looking for a cloud service geared toward business-based storage and collaboration.

COMBINE YOUR CLOUD STORAGE

So you want to go the free route. As in, you want to sign up for as many different cloud storage providers as you can get your hands on and find some magical way to mash them together into a single, unified chunk of storage?

The most obvious way to do this is to install each service's desktop app and then manually assign each to a particular subset of your files – perhaps Dropbox for your MP3s, Bitcasa for your movies and Box for your documents, etc. It's not pretty, but it's probably the way to beat the cloud storage game without spending a single penny.



CloudKafé's interface is a bit more 'Windows 8 Modern' than 'Windows 7 Explorer', which may or may not be to your file-browsing liking.

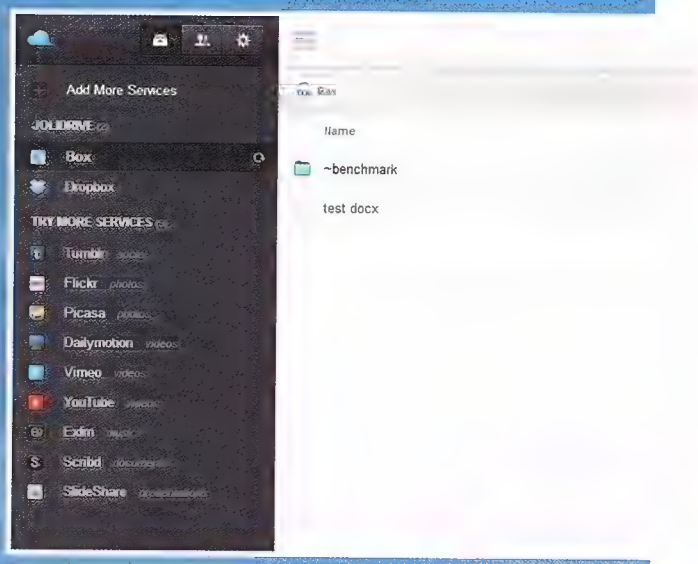
Let's get to it. There's a web-based application, Jolidrive (www.jolidrive.com), that allows you to access a number of different cloud services via one convenient portal. The best part of the equation is Jolidrive's cost: absolutely free.

Once you've signed up for the app, you're presented with a screen that allows you to combine your cloud storage accounts with your master Jolidrive account. Supported cloud storage services include a number of those mentioned in this article – Box, Dropbox, MediaFire, SkyDrive, SugarSync, and Ubuntu One (to name a few).

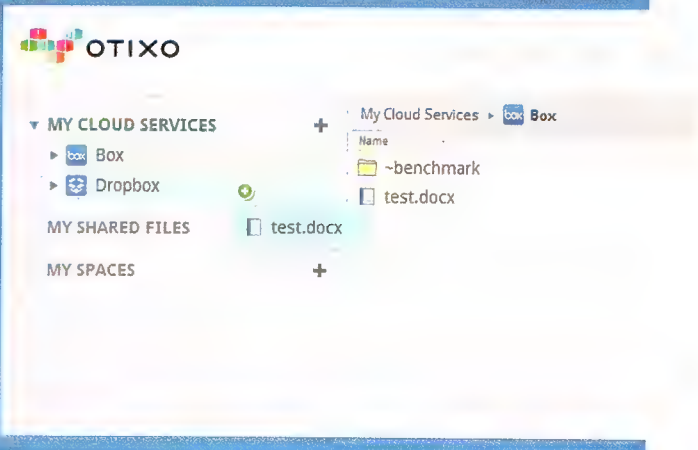
The one bummer? Jolidrive is akin to read-only access. You can't move files around your various cloud services, nor can you even use Jolidrive to upload files – downloading and streaming only.

You'll find that this is the one unfortunate caveat of a number of similar, free services. CloudKafé (www.cloudkafe.com) is another web-based mash-everything-together cloud-storage organiser – one with a user interface that bests Jolidrive in some aspects. It allows you to grab items from your various cloud services by dragging them into a CloudKafé basket, which you can then allow others to access by emailing them a link via CloudKafé itself. Want to upload files directly to your individual cloud storage providers via CloudKafé? No dice.

The paid-for web app Otixo (www.otixo.com) does allow you to copy and paste files between connected cloud services



Jolidrive presents a no-fuss method for combining your cloud storage providers, but you can't really do all that much with your data once combined.



Otixo packs some powerful functionality into its cloud-storage combining, but don't expect a free pass.

providers, but it lacks a lot of the basic functionality found in other cloud-storage apps.

We love Otixo's interface and feature set, in that the application lets you perform all the basic functionality (download, deletion, sharing, and uploads) that you'd otherwise expect to find in your individual cloud services. Like CloudKafé, you can create virtual spaces of files – groupings of data that can be populated with any of your files from your individual cloud services – which you can then share with others.

The rub? Otixo's paid-for service's file-uploading feature only allows one file at a time (no folders) into a particular cloud service. What we wouldn't give for a basic uploading function, or at least the ability to upload full folders. So it's a small price to pay to be able to take advantage of the web's more popular cloud-storage providers.

howto

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

HARDWARE

MARGIN CALL

How do you account for the margin of error in the performance of a computer part? For example, if the new GeForce GTX 780 made by company A is 2 percent faster than the GTX 780 made by company B, then you can't really say that the one is better than the other because the results may be due to something other than the video card itself if it's that small of a difference. What measurements do you guys have in place to make sure that the difference in performance between two components are due to the parts themselves and not due to something like a hiccup in the power current, or even a SATA cable that is a tiny bit faster than an identical cable?
Patrick McGuirk

There will always be small discrepancies between benchmark runs for video cards due to the nature of the benchmarks themselves, alongside variances in power delivery to the card, cooling differences, and so on. To make sure the numbers are reliable, we run all our tests on the exact same system that has been in place for over a year and a half now, so there are no other variables to consider. We also run each test multiple times to make sure there are no anomalies being reported. It's also important to note that our scores may differ from your scores, as no two GPUs are exactly the same, and performance of the same GPU from two different manufacturers might be very close, so the difference really comes down to warranty, software, and overclocking ability.
Josh Norem

Whether you use Thunderbolt or FireWire for your external HD is largely a matter of convenience.

MAC

EXTERNAL HD FOR EDITING

I have a 2011 MacBook Pro with a 1GB graphics card, and I am running Final Cut Pro X. It works well, but I'm running out of disk space. My machine has FireWire rather than Thunderbolt, and I was wondering if I could edit video on an external drive and still achieve good performance? I also figured if I used an external drive, it'd be sensible to have it configured as a RAID 1, so if the drive failed there'd be a duplicate. But if I use something like a G-RAID mini 2TB drive, will it be slow doing video once it is running in RAID 1?
Marcus Mackay

Are you sure you don't have a Thunderbolt port? The early 2011 MBP was the first model to include one. It doesn't matter, though, a FireWire 800 port is good enough for offline video editing. I'm much less convinced of the wisdom of RAID 1, though. RAID 1 uses one drive to mirror the other, so it only protects you against the hardware failure of the drive itself. If you delete files by accident, or they become corrupted, that damage is propagated to the mirror drive as well. You'd be better off assigning that extra drive as a Time Machine backup for your working drive. That way you never lose more than an hour's work, regardless of the cause. RAID is more about maintaining continuous uptime for servers than backing up your data.
Luis Villazon

It's normal to see a little variance in graphics card benchmarking results.

HARDWARE

X16 OR DUAL X8

The October article "Put It To The Test" answered whether a x16 PCIe slot ran faster than x8, but didn't really clarify what happens if you run SLI in two x16 slots. Do they function as two x16 or is there degradation so they run at less than that? I'm thinking about a Z87 ASUS ROG Maximus VI Hero board for my next build. It says "x16 or dual x8" in its documentation. What does that mean for my big expenditure of two expensive video cards? Does the SLI bridge solve any performance problems between the slots?
Chris Ajemian

Many motherboards (well, actually the CPUs), including the Maximus VI Hero, don't have enough PCIe lanes to run more than one video card at x16, so if you use two cards in SLI/CrossFireX each PCIe slot drops down to x8. The good news is that those slots are PCIe 3.0, which means that in x8 mode they each have the same bandwidth as a PCIe 2.0 x16 slot. You won't see any slowdown in your expensive cards. Even if your cards only have PCIe 2.0 connectors, the slowdown will be on the order of 1 or 3 percent. And the SLI bridge does solve performance problems between the slots, in that SLI will not work without it.
APC staff

LINUX

BY YOUR COMMAND

I am a fairly recent convert to Linux, but I have been using command line products under Windows for many years. One capability that I have in a Windows terminal (using the take command by jpsoft) is the ability to display a list of files and then to tick the ones I want to perform an operation on. That is, the ability to visually select files. I cannot find such a function in Bash, so I wrote several simple scripts to provide some of this functionality.

I have these scripts in my home directory, and define an alias to each so that I don't have to have them in my path for them to be always available. They all work by writing a file of filenames to the current directory, and then operating on these files. Are you aware of any

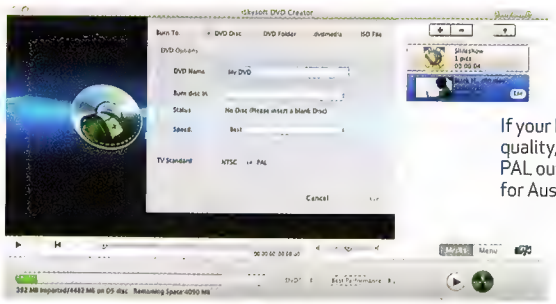
programs that are, shall we say, more polished than my crude Bash scripts?
Robert Solomon

There isn't room to show the scripts you used, but it is an interesting approach and well done on getting your hands dirty creating a solution to your needs. Regarding the location of the scripts, these should go in ~/bin rather than directly in your home directory. That directory is usually in your path, and can be easily added if not, so there is no need for aliases or full paths. Alternative, you can define the operations you need as functions in your profile by adding them to ~/.bash_profile:

```
makelist() {
  commands go here
  and here
}
```

These functions are available to any shell as if they were built in commands or scripts in your path.

However, it seems that what you really want is some sort of file manager for the terminal, and there are plenty of those to choose from. The most popular is Midnight Commander (**www.midnight-commander.org**), which may already be installed on your system. If not, it will certainly be available from your package manager, usually under the name of mc. Midnight Commander follows the classic two pane file manager layout, but within a terminal and keyboard controlled. The function keys bring up the various options; the ones you will need most are F2 to operate on selected files, F9 to move to the Menu Bar and, of course, F1 for help. The help documentation is fairly thorough, except when it comes to your original question. To select files for later operation, press Insert. Apart from the commands available in the menus, you can pass selected files to any command you like with F2-@ or run commands directly from the built-in prompt.
APC staff



If your DVDs are lacking in quality, make sure you select PAL output when burning them for Aussie TVs.

MAC

BURNING VIDEO TO DVD RESULTS IN DROPPED QUALITY

I have produced some slideshows using iMovie. When I burn them to disc using iSkysoft DVD Creator, they're never the correct format to play on my TV and I have to change my TV settings. Also, the quality is poor, lacking the detail that was present when viewed on my iMac. Would you recommend using Roxio Toast 11? If so, what settings should I apply to get the best picture quality when played back on my TV? The videos are mainly of weddings, which I send on to the guests. The reason for using DVD is because all the guests have access to DVD players but not everyone has a computer.
Allan Keeler

I haven't used DVD Creator before, but from my quick skim through the trial version, it doesn't look as if there is much you can do wrong. I would say the only potential gotcha is that the default output when you click 'Burn', is for the American NTSC TV standard and you need to click the radio button to change this to the Australian PAL format. Is this the TV setting that you're changing?

Also, bear in mind ordinary DVD quality is never going to look as good as the images on your Mac. Standard definition is only 720 × 480 pixels. Roxio Toast has some extra settings you can fiddle with, but it isn't going to change the fundamental limits of DVD resolution.
Luis Villazon

IOS

TOO LATE TO UPDATE TO IOS 5?

I have an iPad 2 running iOS 4.3.3. I put off upgrading to iOS 5, because I wanted to wait until it was more stable and then I didn't get around to it. Now there are apps I want to install that require iOS5, so I want to upgrade. But iTunes only gives me iOS 7 as an option, and I'm not ready to make that jump for the same reasons.
Sahir Rotan

I'm a fully paid-up member of the 'if-it-aint-broke…' club, but skipping two whole OS releases isn't usually a good idea because you get left behind by apps and technical support. Delaying an upgrade for six months while you wait for the first maintenance release is perfectly reasonable, but if you wait too long you can get stranded, like you've discovered. You can't directly upgrade to iOS 5 now because Apple has stopped digitally signing it (and iOS 6, too) for most devices. Without a valid digital signature, iTunes won't install the update.

There's another way, though. At **iphonefirmware.com/firmwares-download/**, there are links to past iOS updates that already have a valid digital signature.
Matthew Bolton

HARDWARE

MISSING IPHONE SCREWS

I recently bought an iPhone 4S second hand from eBay. Within one week it had stopped charging or even being recognised by my MacBook and iTunes. The dock connector was clean and free from fluff, so there should've been a connection made. Apple forums suggested the battery needed replacing, so I bought one off the web and changed it myself. On opening up the back, I found the battery had been changed before, but whoever had done it had not replaced the two screws that hold the battery in place (they were missing when I got the back off). I went ahead and changed the battery, but the new battery is still not charging or being recognised. I have now sent away for a packet of replacement screws, but I can't help thinking if they were important, why did it work for a while without them? Also, which size screw goes in the holes?
Mike Keegan

Those screws hold the battery connector in place, rather than the battery itself. Without them, the connector is free to bounce around and only makes intermittent contact, so you definitely need to replace them. The top one is a 1.7mm Phillips screw and the lower one is a 1.5mm Phillips.
Matthew Bolton

You can still update an iOS 4 device to iOS 5, but you'll need to seek the necessary firmware files from sources other than Apple.

Restore, refresh or reinstall Windows 8 or 8.1

PC behaving strangely or sluggishly? Discover what options you have for restoring Windows to its best with our straightforward guide.

Windows RT and Windows 8.1 (which is available as a free update to Windows 8) are the most evolved versions of the operating system yet and are practically bullet-proof, but if you're unfortunate enough that something should go wrong, what can you do to get your machine back up and running?

Thankfully, Windows comes with everything you need to take charge of the situation and fix problems using a combination of different tools. In this how-to we'll show you how to first make sure your important data is backed up, then investigate the various utilities that can bring your device back to life, from a simple rollback of key system files and settings to a full-blown reinstall of Windows itself. Whatever the problem, you'll find the solution here!

Back up your files online

Add an extra layer to your emergency recovery plan. As anyone who's experienced a hardware failure will know, you can never have too many backups, so even after using File History to back up your files, you should explore another option, just in case. We recommend using an online backup, because it means there's a copy of your files stored in a separate physical location for extra protection.

The obvious choice for Windows 8.1 users is to install the free SkyDrive desktop app (**apps.live.com/skydrive**), which enables you to sync up to 7GB of files to the cloud for free. If you're using Windows RT, there's a built-in app which does the same job.

If you need more storage space, you can purchase additional gigabytes in the 'Manage storage > Upgrade' area of SkyDrive online.

Take a backup

Keep your work safe with File History

If you've not yet done so, now is the right time to take the steps required to protect your priceless photos, home movies, music library, important work documents and other irreplaceable files and settings from potential disaster. The good news is that it couldn't be easier, and all the tools you need for backing up your data and settings are provided in Windows 8.1 itself.

When it comes to backing up your files, the File History tool is your first port of call. To access it, open the Search charm and type **backup** into the Search box. Now just click 'Save backup copies of your files with File History' to open it. You'll need a separate hard drive to store your file backups; a USB drive is best, but you can also store them on a network drive by clicking 'Select drive' followed by 'Add network location'.

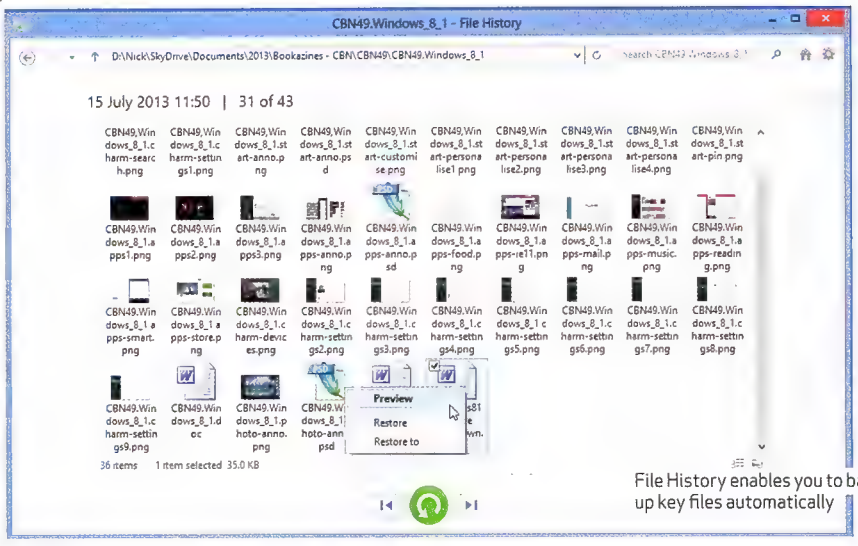
By default, the built-in File History tool automatically backs up all the content from your libraries, contacts, favourites, SkyDrive folder and desktop. If you want to back up any folders, as well, you can do so by adding them to a library, and you can choose 'Exclude folders' on the main File History screen if you want to remove specific folders from the backup.

Once you've set everything up, click 'Turn on' and File History not only starts backing up your files, but backs up different versions of them, too, enabling you to roll back files to earlier revisions should you need to.

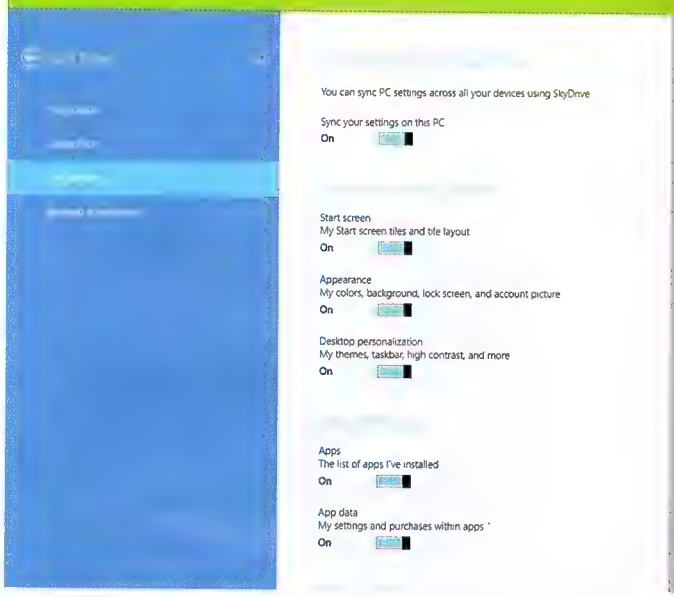
QUICK RECOVERY

There are two ways to recover files. Firstly, if you want to restore lost or accidentally deleted files, click 'Restore personal files' in the main File History window. From here you can browse your backups by location or library, or search for specific content.

If you want to restore an earlier version of a file, the process is just as simple. All you need to do is browse for it in an Explorer window, select the file in question and then click the History button on the Home tab of the ribbon to see a list of previous versions of the file before restoring the one you want.



File History enables you to back up key files automatically



Back up your settings

USE WINDOWS 8.1'S BRILLIANT SYNC YOUR SETTINGS TOOL WITH ULTRA PROTECTION IF DISASTER STRIKES

If you log on to your Windows 8.1 PC using your Microsoft account, you can take advantage of Windows' built-in Sync Your Settings feature. Although this tool is mainly designed as a way of synchronising your personal settings across all the Windows 8.1 and Windows RT devices you use, it also serves as a handy way to back up those key preferences so you don't have to set them all up again should disaster strike and one of your devices fail.

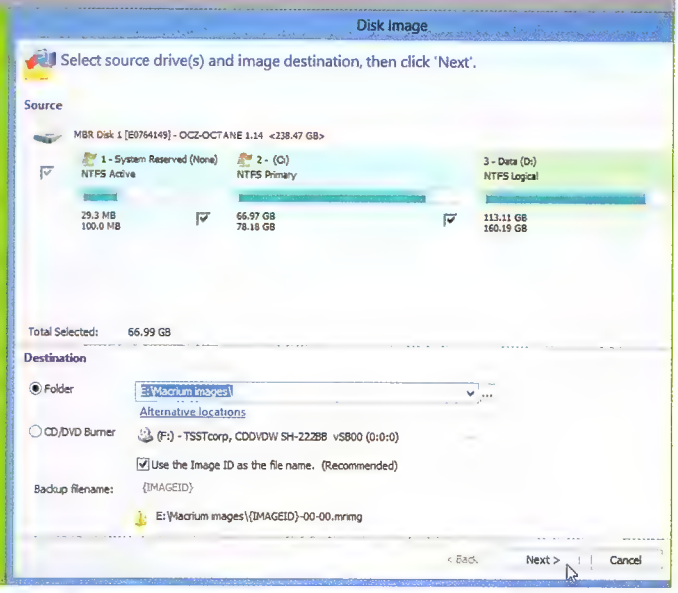
To make sure Sync Your Settings is switched on and choose exactly which settings you wish to back up, open the Settings charm and click the 'Change PC Settings' link, then select the 'Sync Your Settings > SkyDrive' option from the left-hand pane. You'll find all the switches you need to turn the feature on and off, and you can tell Windows to exclude certain settings from the backup, such as passwords or browser settings. You might decide to do this for security reasons.

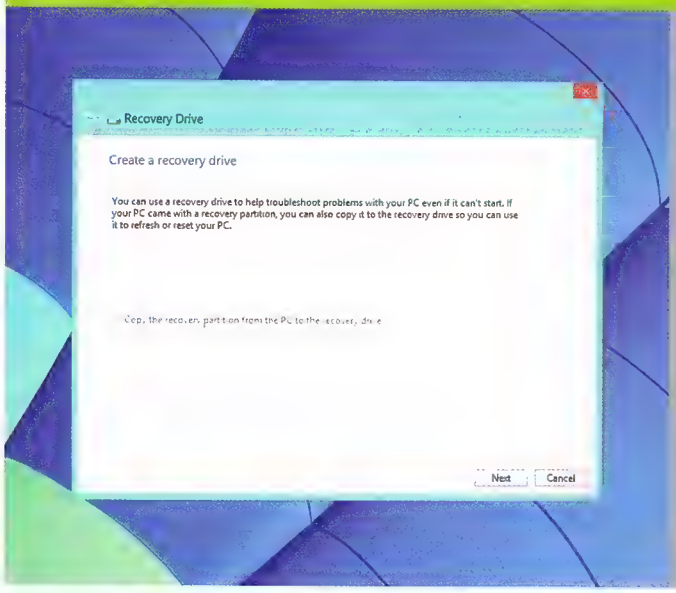
Take a drive image

MAKE A COMPLETE BACKUP OF YOUR COMPUTER'S HARD DRIVE WITH MACRIUM REFLECT FREE

Why not take a backup of your entire system, including Windows itself? This will enable you to quickly restore your computer to exactly how it was at the point in time when a backup was taken, and is much faster than going through a recovery or reinstall. You'll need a free program called Macrium Reflect Free to do this; you can download it from **www.macrium.com/reflectfree.asp.**

There are two basic back-up options, but we're going to choose 'Create an image of the partition(s) required to backup and restore Windows'. Make sure the correct drives have been selected, then click the '...' button next to the Folder to select a location on your back-up drive. Finally, click 'Finish > OK' and the backup will be created. Once complete, check that the backup is not corrupt by switching to the Restore tab and clicking 'Verify image' next to it. Finally, select 'Other tasks > Create rescue media' to create a recovery disc or USB drive in case of disaster.




Recovery Drive
Create a recovery drive
You can use a recovery drive to help troubleshoot problems with your PC even if it can't start. If your PC came with a recovery partition, you can also copy it to the recovery drive so you can use it to refresh or reset your PC.
Next
Cancel

Create rescue media

TAKING A FEW MINUTES TO MAKE A RECOVERY USB DRIVE COULD SAVE YOU HASSLE IN THE FUTURE

A recovery USB flash drive lets you access essential repair and recovery options that can save the day if your PC or tablet fails to boot. If your Windows 8.1 device has a recovery partition, you can store that on the drive, too, just in case you need to restore Windows on a brand new drive. A basic recovery drive without a recovery partition requires a 256MB USB flash drive, but you'll need a drive at least 4GB in size if you plan to make a backup of the recovery partition, too (recommended).

To create the drive, first plug in your USB flash drive, then type the word recovery into the Search charm. Select the option 'Create a recovery drive' under Settings, then simply follow the on-screen prompts to create your recovery stick. After the process has finished, select the option to delete the recovery partition only if you're running low on storage space (which may be the case if you're using a tablet) — otherwise leave it in place.

Refresh or restore

If the problem with your device is relatively minor, you can often fix it without effecting your data.

Doing a restore or refresh should keep most of your existing programs installations intact.

Your PC has run into problems and you've exhausted all troubleshooting angles, so what can you do to try and get things working properly again? If you're running Windows 8.1, the next step is to investigate the System Restore tool. System Restore works in a similar way to File History, only it affects system and program files instead of your personal data. Snapshots of these files – known as Restore Points – are taken at key moments during general use, and if you run into problems, you can try rolling back to a previous Restore Point to see if it fixes the problem.

System Restore usually works best when your problem has been caused by a recent change to your computer, typically through installing or updating new hardware, software or Windows itself. The guide opposite reveals how to go about accessing and using System Restore, either from within Windows or via your computer's recovery menu.

REFRESH YOUR PC

If System Restore doesn't do enough to fix the problem, or you're running Windows RT, you can try a more radical step – refreshing your PC. This basically restores Windows by wiping out any desktop programs that you have installed, along with your personal settings, but leaves your other apps and data untouched.

If Windows is working well enough for you to access it normally, open the Settings charm, then click 'Change PC settings' and select the 'Update and recovery' section. Now hit Recovery and tap 'Get started' under 'Refresh your PC without affecting your files'. Follow the prompts it gives you, then sit back and wait for the process to finish.

You can also try refreshing your device from the troubleshooting screen that appears when Windows fails to load, or when you boot from your USB recovery disk. Here, select Troubleshoot followed by 'Advanced options' to access the Refresh option – the process is identical to when you access it through Windows itself.

Refreshing your PC is relatively quick and can bring it back to life if it becomes sluggish or unstable. After the refresh has been performed, Windows keeps you informed as it reconfigures your PC. Your data is left untouched, and Windows reinstalls any apps you'd previously downloaded from the Windows Store.

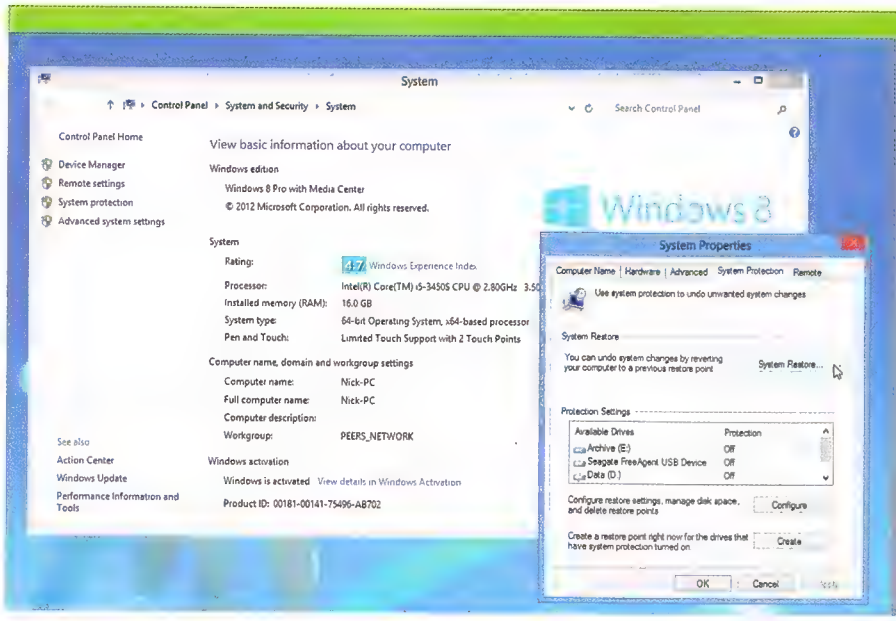
Any software that came pre-installed with your device is also left alone, such as Microsoft Office on a Surface RT tablet, for example.

You lose any settings you've applied, plus any desktop programs you've installed manually from a CD/DVD or downloaded. A complete list of these should be placed on your desktop after the refresh completes – if you can't see the list, right-click the desktop and choose 'View > Show desktop icons'. The list is a comprehensive one, and where possible provides links to the program's home page, from where you can download the latest version to reinstall on your PC.

BEYOND A REFRESH

Unfortunately, refreshing your PC won't always cure all ills. You may find that your device still doesn't function as it should after you've refreshed it, or the refresh procedure might not work. If Windows comes across a problem, it'll inform you of the fact, try to resolve it and then – if the fix fails – undo all the changes it's made, leaving you where you started.

If this happens to you, then the problem is one that can't simply be resolved by refreshing your PC. Fixing it will involve something more drastic: a complete wipe and reinstall of Windows itself. Turn the page to find out how this works and what to do in order to make things as simple as possible after you've reinstalled or recovered Windows.



Access System Restore

IF YOU CAN'T GET INTO WINDOWS THERE'S NO NEED TO PANIC

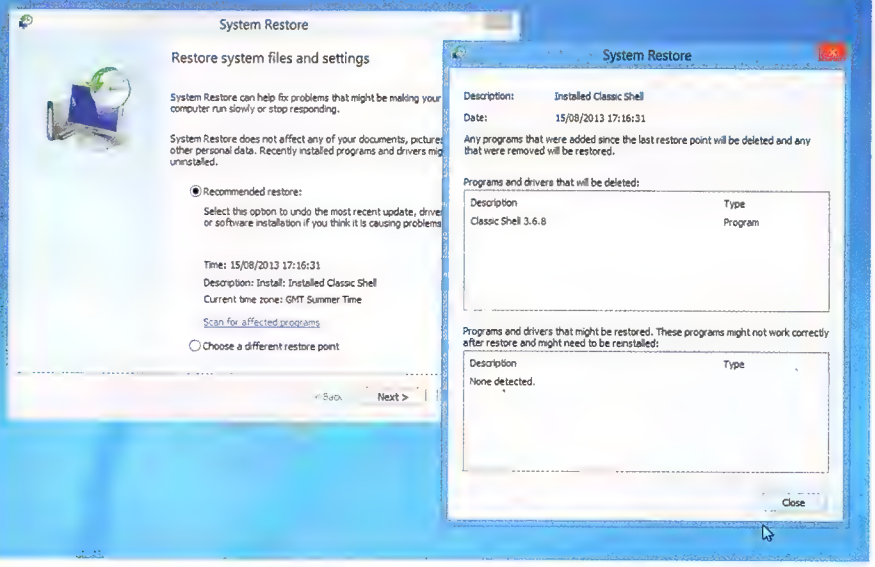
If you can boot into Windows, you can access System Restore via the desktop. Press Win+X and select System, then 'System Protection' followed by the 'System Restore' button to open it.

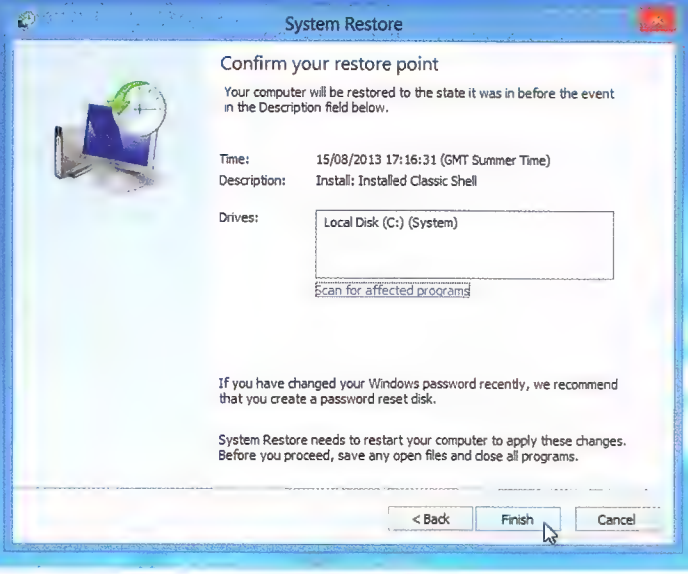
If Windows won't start, Automatic Repair may suggest using System Restore automatically — click Restore if prompted. If the option doesn't appear, boot from your USB recovery disk, then select Troubleshoot followed by Advanced and then 'System Restore'. Do note, this method won't work in Windows RT.

Browse Restore Points

SHOULD TURN BACK THE CLOCK

By default, Windows recommends that you use the most recent Restore Point; in fact, you may even find it's the only Restore Point offered. Make a note of the time and date when it was taken, and click 'Scan for affected programs' to see which programs and hardware drivers will be affected by rolling back your PC to this point. You'll see a list of the programs that will be removed if you choose it, and others (including older versions) that will be restored. This should help you decide whether to use it or not.


System Restore
Restore system files and settings
System Restore can help fix problems that might be making your computer run slowly or stop responding.
System Restore does not affect any of your documents, pictures, other personal data. Recently installed programs and drivers might be uninstalled.
Recommended restore:
Select this option to undo the most recent update, driver or software installation if you think it is causing problems.
Time: 15/08/2013 17:16:31
Description: Install: Installed Classic Shell
Current time zone: GMT Summer Time
Scan for affected programs
Choose a different restore point
< Back
Next >
System Restore
Description: Installed Classic Shell
Date: 15/08/2013 17:16:31
Any programs that were added since the last restore point will be deleted and any that were removed will be restored.
Programs and drivers that will be deleted:
Description
Type
Classic Shell 3.6.8
Program
Programs and drivers that might be restored. These programs might not work correctly after restore and might need to be reinstalled:
Description
Type
None detected.
Close


System Restore
Confirm your restore point
Your computer will be restored to the state it was in before the event in the Description field below.
Time: 15/08/2013 17:16:31 (GMT Summer Time)
Description: Install: Installed Classic Shell
Drives: Local Disk (C:) (System)
Scan for affected programs
If you have changed your Windows password recently, we recommend that you create a password reset disk.
System Restore needs to restart your computer to apply these changes. Before you proceed, save any open files and close all programs.
< Back
Finish
Cancel

Roll back your computer

CHOOSE A RESTORE POINT AND SEND YOUR PC BACK IN TIME

If you think your problem can be fixed by restoring the recommended Restore Point, click Next and follow the prompts to roll back your PC. If this doesn't work, or you want to try an earlier Restore Point instead, select 'Choose a different Restore Point' and click Next. Browse through the available Restore Points, noting what would be affected by choosing each one. After restoring your computer, you can undo the process if it doesn't have the desired effect — simply reopen System Restore.

Reinstall or recover Windows

If all else fails, a full recovery or reinstall will fix your problem — but make sure you've backed up first!

If nothing else works, you can go the whole hog, wipe your hard drive clean and restore Windows to its factory settings. This approach will obviously delete any personal data you have saved on the drive, so make sure it's backed up first using our guides on pages 78 and 79 of this feature. It's also a good idea to make a note of any desktop programs that you've installed on your computer so you can download and restore them after Windows has been reinstalled.

REINSTALL WINDOWS

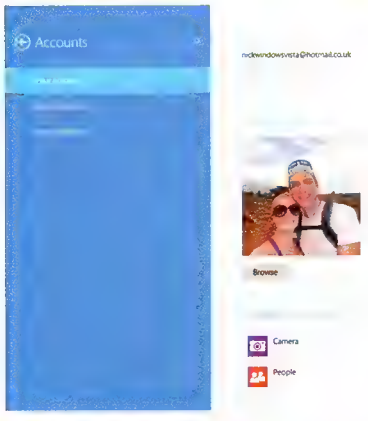
The simplest way to reinstall Windows is through Windows itself. Open the Settings charm, select 'Change PC settings > Update and recovery > Recovery' and click 'Get started' under 'Remove everything and reinstall Windows'. If you can't even boot into Windows, use your USB recovery key instead — select Troubleshoot followed by 'Advanced options' before clicking on 'Reset your PC'. You may be prompted to install recovery media — DVDs or a USB thumb drive — if your recovery files have been stored there. You're then asked about cleaning your drive. If security isn't an issue, choose 'Just remove my files', but if you're planning to give the PC to someone else, we recommend 'Clean the drive fully'. Once this is done, click Reset and wait for Windows to wipe the drive and reinstall itself.

If you can't boot into Windows at all, you can access the Reset option via your USB recovery disk — choose 'Troubleshoot > Advanced options' to access it. If you're using a PC, you can boot it from a Windows installation disc. This is less straightforward, but still fairly easy. You'll need the product key you received when purchasing Windows 8.1, and you'll need to specify which drive to install Windows on, so make sure you choose the correct one — select it and click Format to delete everything on it before installing Windows 8.1 from scratch. Once that's done, the rest of the process is simply waiting and then answering the simple questions that are put to you.

POST REINSTALL

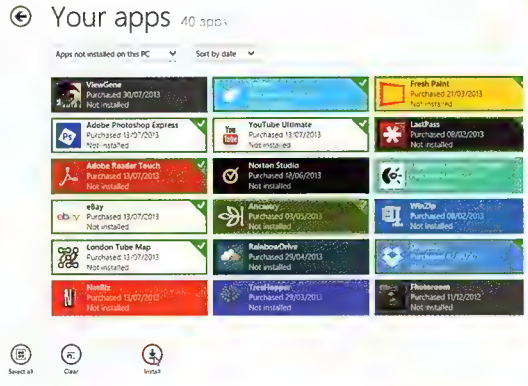
Once your computer has been restored, you'll need to spend some time reinstalling apps, applying preferences and restoring backed-up data. The guide below reveals everything you need to know. You'll need to reinstall your key desktop applications, too. Again, take the time to download the latest versions and set each one up. This can all take an hour or two — to speed up future reinstalls, check out the box below-right to create the perfect Windows image, complete with all your apps, programs and settings in place.

Step-by-step: Use your backups



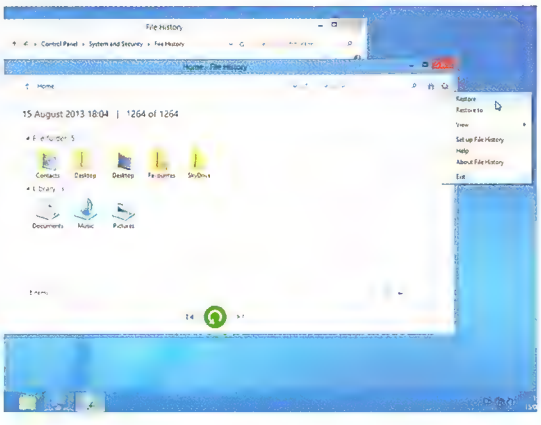
1 RESTORE SETTINGS

You'll need to log into your Microsoft Account in order to restore your synced settings and previously installed apps. By default, your settings should be restored automatically — open the Settings charm, select 'Change PC Settings' and choose 'SkyDrive > Sync settings' to verify this. You'll need to click the 'Verify' link under 'Accounts' to get the code required to add your PC back into the trusted list.



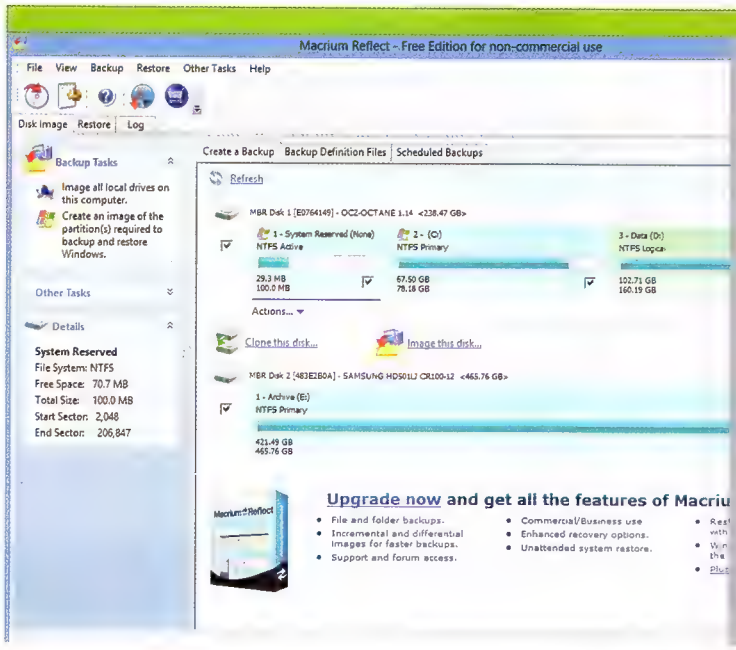
2 RESTORE APPS

Open the Windows Store and start by clicking the Updates prompt to update all the built-in apps to their latest versions. Once complete, right-click or swipe down to reveal the options bar and tap 'Your apps'. All previously installed apps are listed — click 'Select all' or tap on each app you wish to restore before clicking Install to bring them all back, complete with your user settings.



3 RESTORE FILES

Finally, restore your files using File History. With your back-up device plugged in, type file history into the Search charm and click 'File History'. You should see your File History backup, so select it and click 'Turn on'. Choose 'Restore personal files', then click the Settings cog and choose Restore to recover your data. This can take a little time, so be patient.


Macrium Reflect - Free Edition for non-commercial use
File View Backup Restore Other Tasks Help
Disk Image Restore Log
Backup Tasks
Image all local drives on this computer.
Create an image of the partition(s) required to backup and restore Windows.
Other Tasks
Details
System Reserved
File System: NTFS
Free Space: 70.7 MB
Total Size: 100.0 MB
Start Sector: 2,048
End Sector: 206,847
Create a Backup Backup Definition Files Scheduled Backups
Refresh
Actions...
Clone this disk...
Image this disk...
Upgrade now and get all the features of Macriu
File and folder backups.
Incremental and differential images for faster backups.
Support and forum access.
Commercial/Business use
Enhanced recovery options.
Unattended system restore.

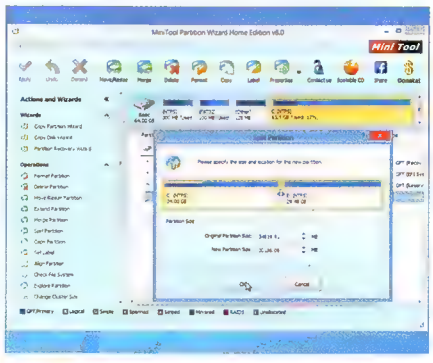
Speed up future Windows reinstalls

Reinstalling and setting up Windows again can be a chore, so why not speed up future reinstalls by creating a perfect recovery image? After reinstalling Windows and your apps, reinstall your key programs and set them up as you like them. Then, before you restore your File History backup, launch Macrium Reflect Free and take a new drive image. Create a recovery CD or USB stick following the prompts, and next time you need to reinstall Windows, make sure your File History backup is fully up to date, then boot from your recovery media before restoring this drive image. All you'll need to do is bring Windows and your apps up to date, and reinstall any new programs you can't live without. Finally, before restoring your File History backup, create a new drive image to use the next time you need to reinstall Windows.

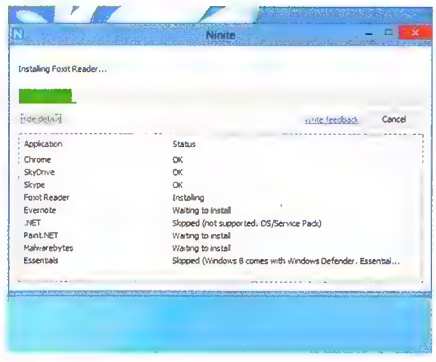
Handy recovery tools

Five freebies to help you get going again in Windows 8 or 8.1

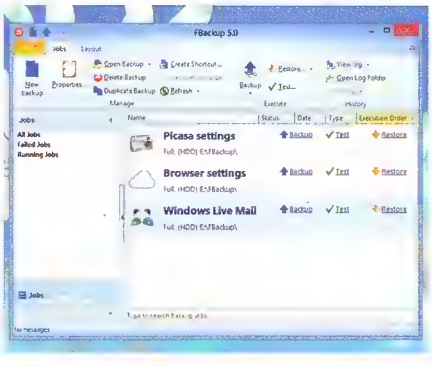
1 DRIVEREASY
This handy tool can find and install any hardware drivers you can't identify after reinstalling Windows. **www.drivereasy.com**



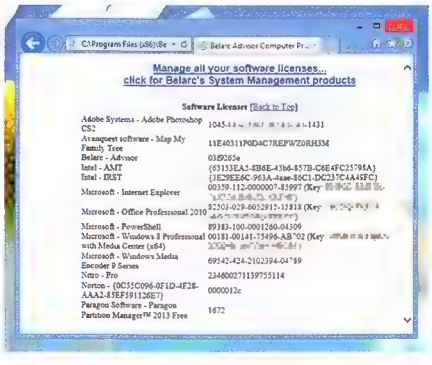
2 PARTITION WIZARD HOME EDITION
Partitioning your hard drive lets you separate your data from your programs. **www.partitionwizard.com**



3 NINITE
This tool lets you pre-select lots of popular apps, then download and install them all in a single package. **www.ninite.com**



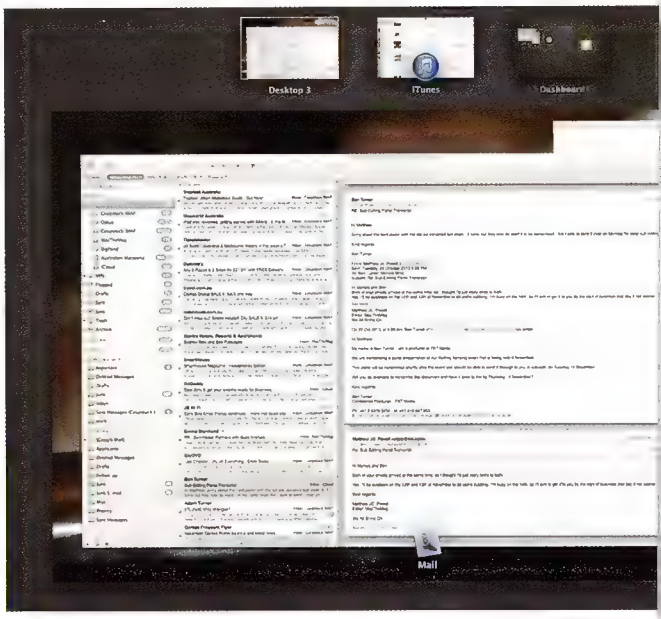
4 FBACKUP
This tool supports plug-ins that make it easy to back up and restore your favourite program settings. **www.fbackup.com**



5 BELARC ADVISOR
Lost or forgotten your Windows or software product keys? Get them back before reinstalling with this. **www.belarc.com**

Mavericks and multiple displays

While Mac OS has supported multiple displays for many years, OS X Mavericks is the first version to do it right. Matthew JC. Powell has some hints for multi-screen power users.

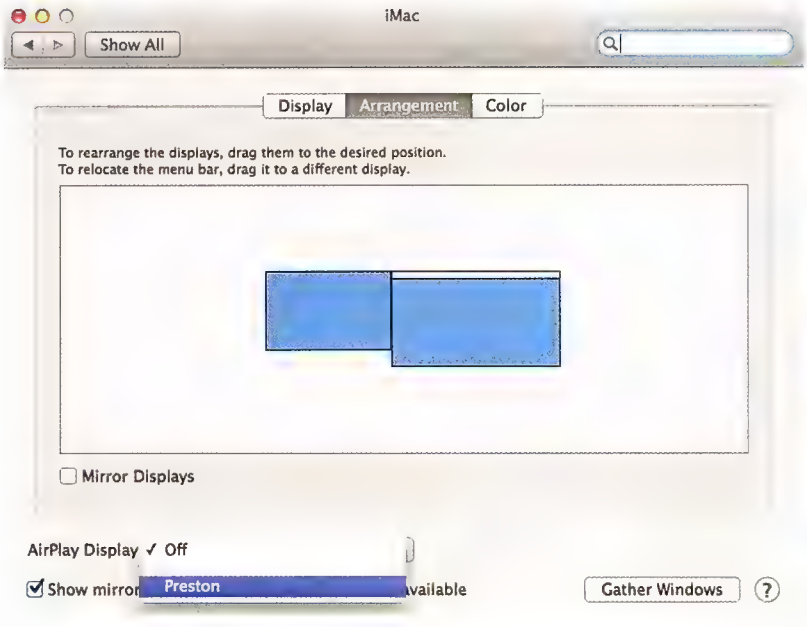


When Craig Federighi announced at the Worldwide Developer Conference that one of the areas Mavericks was going to focus on improving was support for multiple displays, there was an uproarious cheer from the crowd. Surprised at the response, he actually went on to assure the audience that they weren't being given multiple displays for free.

The audience response, and Federighi's surprise at it, revealed an unspoken truth about Mac OS X: lots of people use it with multiple displays, and it's never supported them very well because Apple didn't seem to realise. It's not even just the preserve of power users anymore, either — as portables have overtaken desktops as the mainstay of computer sales, lots of people have an extra big screen to hook the laptop to when they're at their desk.

Whether you're a multiple-display veteran, or whether you just never realised you could use your displays independently, here's a few ways to make Mavericks work better for you.

Start using Spaces. Spaces is a feature OS X has had for a while, but multiple-display users never used it much because it confused the heck out of their Macs (and, by extension, them). Spaces tried to treat all of your displays as one display, so switching between Spaces that included applications on different displays was a recipe for disaster.



Check the menu: Even though any display can have a menu bar, moving it from one display to the other in Display preferences affects which display the Mac sees as primary. This is also where you can configure an Apple TV-connected display.

Now, you can have different Spaces assigned to different displays. Switching between Spaces on one display doesn't affect the other display — just as it should be.

To set up a Space, open up 'Mission Control' (either by clicking its icon in the Dock or by swiping upwards with four fingers on your trackpad). Move the pointer to the upper-right corner of the display on which you want your Space to appear, and click on the + icon. If the application you want in that Space is already open, you can drag one of its windows to the new Space right there in Mission Control. If not, then click on the Space to switch to it, and then open the application.

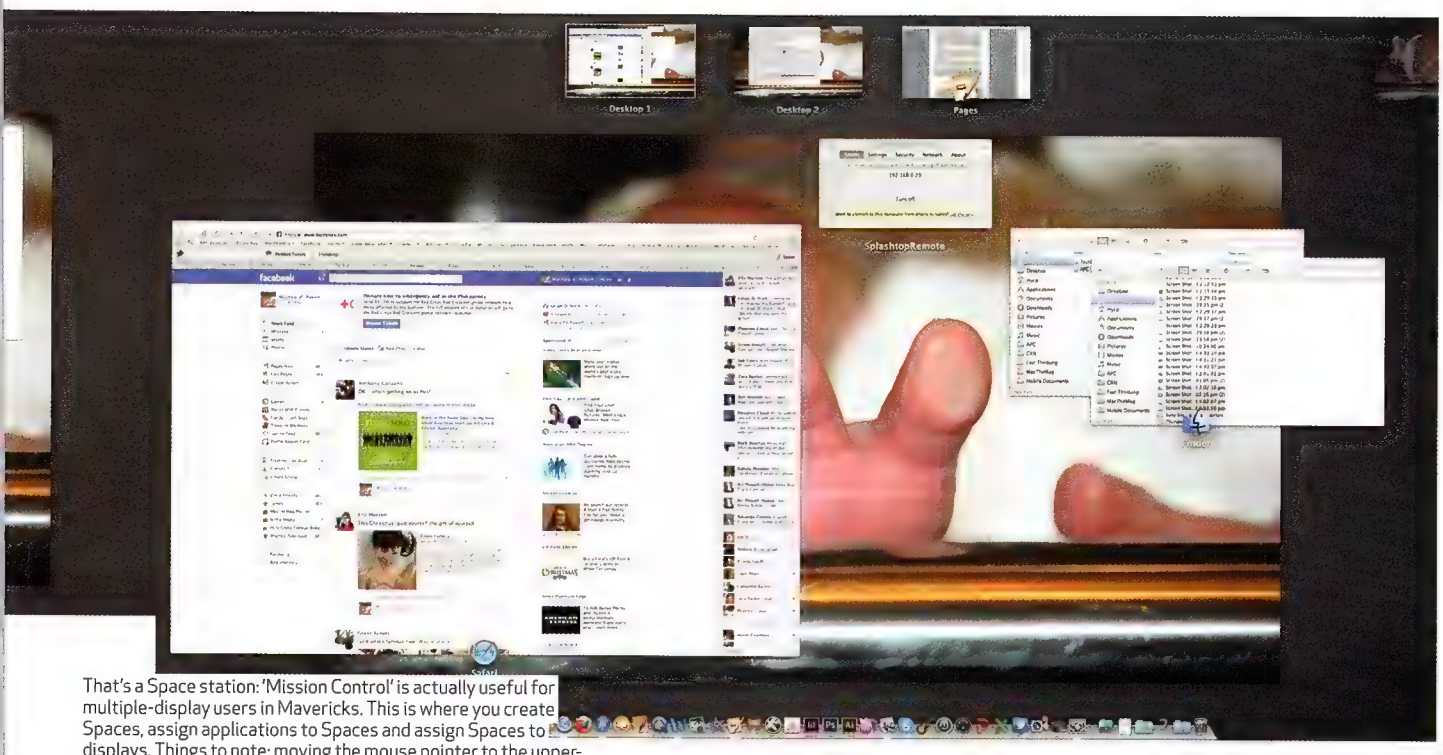
Spaces are very handy because you can put applications in full-screen mode in separate Spaces, and switch between them by switching Spaces. In Mavericks, having an application in full-screen mode on one display doesn't make other displays go blank, as in previous versions of OS X.

At any time you can move applications or individual windows between Spaces using Mission Control. You can also move Spaces from one display to another, but that may require a little bit of trickery. Read on.

MAKE APPLICATIONS USE MULTIPLE DISPLAYS

The way a lot of people use multiple displays is to have their workspace in one display and their toolbars (for Photoshop, Final Cut Pro, etc) in the other. That makes perfect sense, but it's actually not how Mavericks works by default. The default behaviour is for each application to use only one Space, and each Space to exist on one display.

To change that, open 'System Preferences', and click on the 'Mission Control' pane. Deselect the box marked 'Displays have separate Spaces'. You'll have



That's a Space station: 'Mission Control' is actually useful for multiple-display users in Mavericks. This is where you create Spaces, assign applications to Spaces and assign Spaces to displays. Things to note: moving the mouse pointer to the upper-right corner of any display creates a new Space on that display; also, Spaces which contain applications running in full-screen mode bear the name of the application.

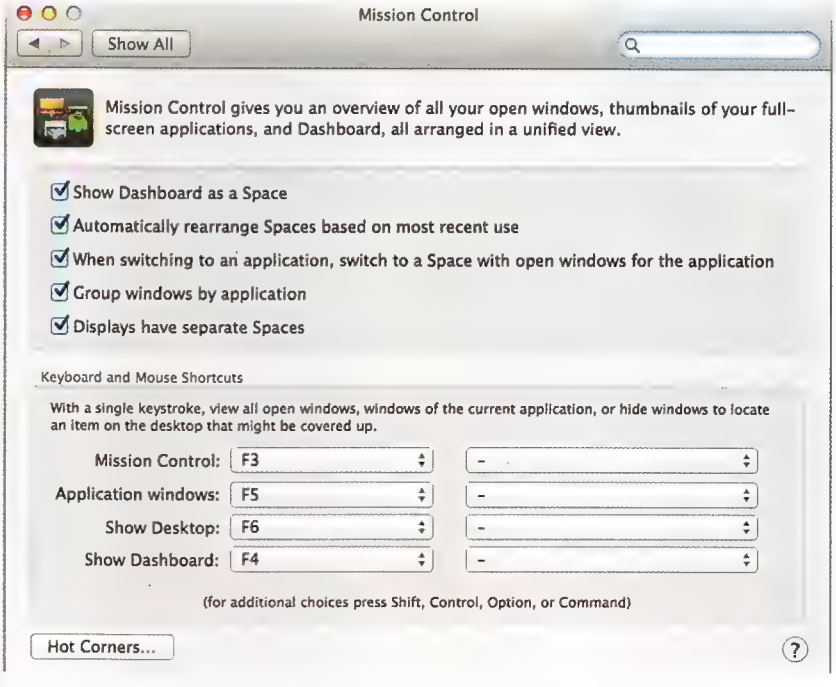
to Log Out (under the Apple menu) and log back in again for this to take effect.

Once that's done, you can go back to having your power-user applications open across multiple displays.

We mentioned above that you can drag Spaces between displays. Owing to a bug that will probably be fixed eventually, you might not be able to do that straight off. However, changing the 'Displays have separate Spaces' setting in 'System Preferences' appears to clear it up.

Swap all your Spaces between displays at once. So you've set up your 17-inch MacBook Pro and your 23-inch Cinema Display with all your Spaces just how you want them — then you trade in the MBP for a 27-inch iMac. Now all those apps you had on the smaller display are stubbornly on the bigger one, and vice versa. Sure you can drag them one by one, but is there an easier way?

Yup. Open 'System Preferences' and click on Displays, then on Arrangement. This setting isn't as relevant as it once was, since in Mavericks you get a menu bar on every display so you don't have to tell the Mac where the menu bar should be. However, the Mac still considers one display 'primary' and all those Spaces and their apps are assigned to it. Drag the menu bar from one display to the other in this preference pane, and all the Spaces assigned to that display will follow.


Mission Control
Show All
Mission Control gives you an overview of all your open windows, thumbnails of your full-screen applications, and Dashboard, all arranged in a unified view.
Show Dashboard as a Space
Automatically rearrange Spaces based on most recent use
When switching to an application, switch to a Space with open windows for the application
Group windows by application
Displays have separate Spaces
Keyboard and Mouse Shortcuts
With a single keystroke, view all open windows, windows of the current application, or hide windows to locate an item on the desktop that might be covered up.
Mission Control: F3
Application windows: F5
Show Desktop: F6
Show Dashboard: F4
(for additional choices press Shift, Control, Option, or Command)
Hot Corners...

Have it your way: Mavericks chafes a key behaviour of multiple displays: you can't, by default have one application spanning multiple displays any more. But you can if you deselect 'Displays have separate Spaces'.

PRESENTATION HEAVEN

Want to have your Mac's display on a big screen, wirelessly? Easy. Just get an Apple TV. Whatever you hook up to the Apple TV — be it a large-screen TV or a projector — can be used as a display by Mavericks.

In 'System Preferences > Displays', you'll see an option called 'AirPlay Display'. If your Apple TV is on the same network as your Mac, you'll see its name in the pull-down menu. Select it, then either mirror your Mac's display or use the Apple TV as a display in its own right — so you can have your notes on your Mac's screen while the presentation's going.

If there isn't a network where you're giving your presentation (rare these days, but still ...) set up an ad-hoc network using your Mac as a base station. Go to the AirPort menu, select Create Network ... and go from there.

iOS 7 essentials: Using Notification Center

Get to grips with Apple's redesigned iPad and iPhone Notification Center.

An iPad or iPhone can be an exceptionally active device, and there's a lot going on behind the scenes at all times. They're is always keeping an eye out for emails, messages, social media activity as well as keeping an eye on your Reminders and Calendar items.

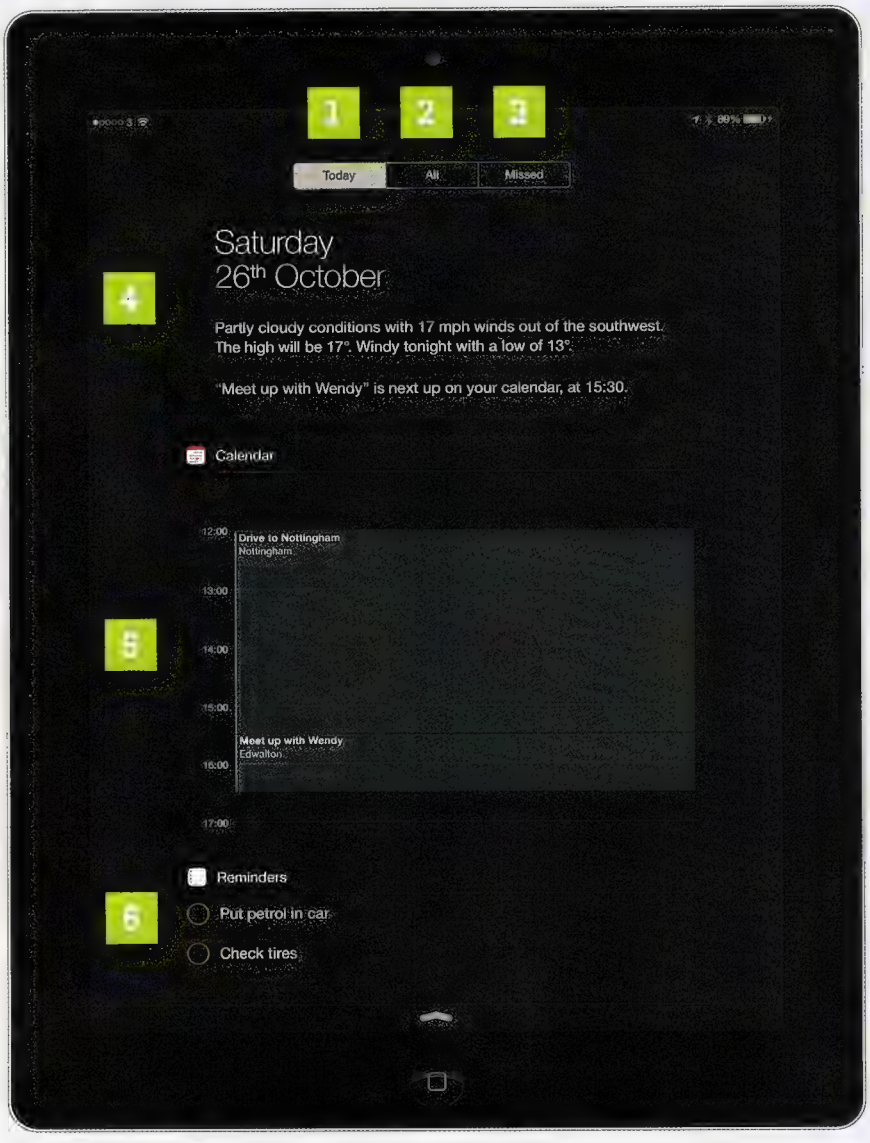
Beyond the obvious, the App Store now automatically updates apps in the background, and these apps can themselves perform certain tasks when in the background. All of this makes it far too easy for you to overlook your device's activity.

So Notification Center is a vital place to know: it enables you to find out what's going on wherever you happen to be.

With one slide down from the top of the screen you get an overview of any new emails, messages, upcoming calendar events, reminders that are due and all kinds of other information. All of this gives you an easy-to-digest picture of what's going on.

Notification Center is an essential part of the iOS 7 operating system. This guide will help you get the most out of it, and you'll soon find it becomes an invaluable tool.

VISUAL GUIDE: NOTIFICATION CENTER



1 TODAY TAB
Drag your finger down from the top of the screen to reveal Notification Center. The default view is Today, which begins with a summary of the day's events, followed by calendar events, reminders, and tomorrow's events.

2 ALL TAB
Swipe left or tap the All tab to see all your notifications. These are notifications you've missed. App Store app updates are included here, which is handy to view what apps you should check for new features.

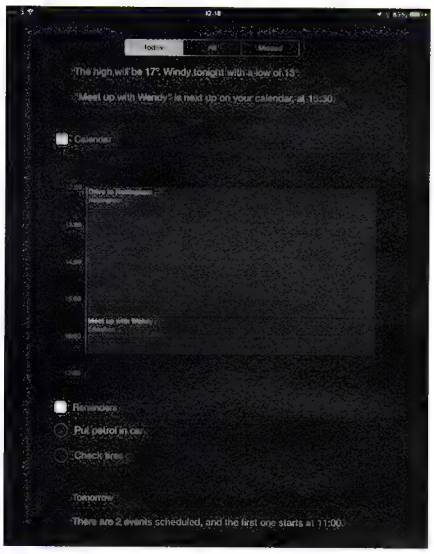
3 MISSED TAB
The Missed tab displays banners and alerts that you have missed. If you use your iPhone/iPad most of the time this may be blank, otherwise notifications from the last few days will be here.

4 SUMMARY
The Summary has a verbal description of what's happening today. It will often have the day's weather followed by any information from your Calendars and Reminders app. If you tap items such as Weather, Calendar and Reminder (or other notifications) it goes to the associated app displaying that information.

5 CALENDAR EVENTS AND REMINDERS
If you have any events in your Calendar for today they will appear here. Tapping the notification opens the calendar at that event. At the bottom of the screen will be any reminders that are marked as due today. You can tap the circles next to the reminders in Notification Center to mark them as completed.

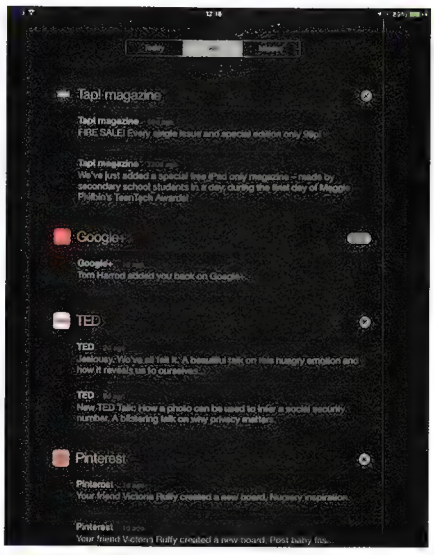
6 TOMORROW
At the very bottom of the screen is a heads-up of how many events and reminders are coming up the next day.

Step-by-step: Use the Notification Center



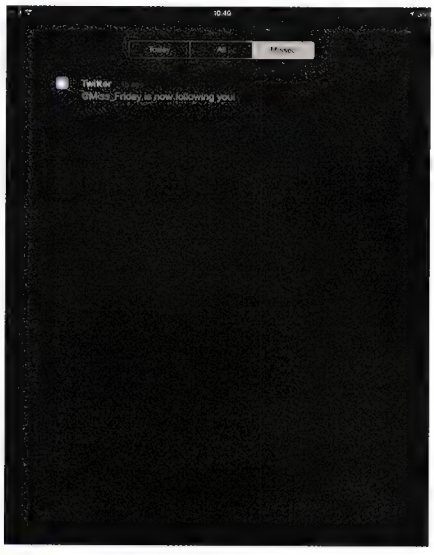
1 SLIDE DOWN

Slide your finger down from the top of the screen to open Notification Center. It's best to get into the habit of starting on the iPad's border (outside the display) otherwise you end up opening Spotlight instead. A dark tint will overlay the display with a weather report and summary of the day, and any Calendar and Reminders events that are due today. Notification Center pauses whatever app or task you are using (although audio will continue).



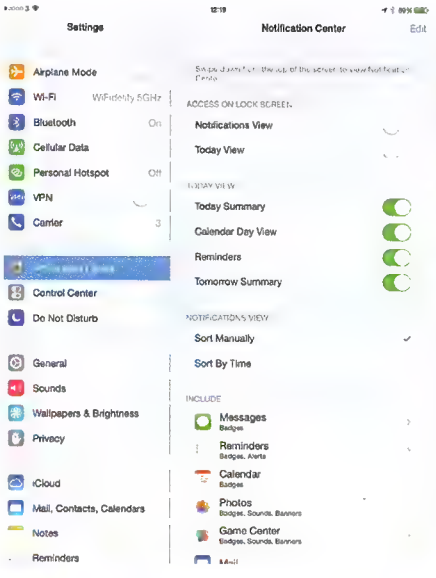
2 VIEW ALL

Tap the All button (or flick left) to view All notifications. This screen displays all of the notifications from the last few days. Many apps are capable of giving you notifications, so the All window is often packed. It's good to check regularly for Notifications from the App Store of apps that can be updated, or have been updated (if you have auto update turned on). If you want to remove a notification tap the X button to the right of it and Clear to remove it.



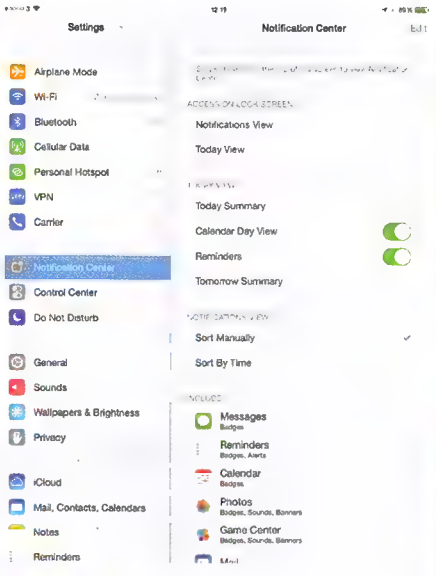
3 MISSED NOTIFICATIONS

The Missed window is handy for looking at events, reminders and other information that appeared as Alerts or Banners on your device, but that you missed (maybe because you ran out of power). You can't clear notifications from the Missed Notifications view, although they will disappear of their own accord. Tap a notification to open the corresponding app. Opening the corresponding app will, however, remove all alerts for it from the Missed notifications view.



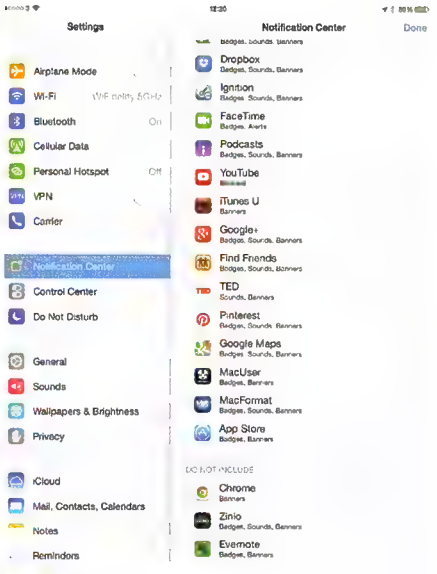
4 NOTIFICATION SETTINGS

To customise the Notification Center display, tap on 'Settings > Notification Center'. If you like to keep your information private you can turn off Notifications View and Today View from Access on Lock Screen. This will ensure that only people who have access to your device can view notifications — a good security measure if you are using a passcode on your iPhone or iPad. Note that you'll need to adjust this setting on each of your iOS devices, as it doesn't sync.



5 EDIT THE TODAY VIEW

Use Notification Settings to fine-tune the Today view. You can turn off the Today Summary text, Calendar Day View, Reminders and Tomorrow Summary. You can also choose to sort notifications Manually or By Time using the Notifications View in the Settings. The Sort Manually approach uses the order from the Include section, whereas Sort By Time goes with which Notification came last. Visit Settings to change these options at any time.



6 REMOVE ITEMS

You might find that there are too many items in your Notification Center, especially in the All view. If you feel it is too cluttered you can remove items from Notification Center by tapping on them and unticking 'Show In Notification Center'. Alternatively click on 'Edit in Notification Settings' and grab the Sort icon (shaped as three horizontal lines) and drag it down to the 'Do Not Include' area. Either method is just as quick as the other.

iOS 7 essentials: Using Control Center

Take control of your iPad with the all-new Control Center

Control Center (or 'Centre' if you have British English as your set language) is a new feature introduced in iOS 7. It enables you a simple and quick way to access a lot of useful controls on your iPhone or iPad. (We've focussed on the latter for this guide, but most of what we discuss also applies to the iPhone.) You access Control Center by sliding your finger up from the bottom of the screen. It's usually best to start with your finger on the bezel and slide upwards. The control will slide up as a grey transparent window with a range of buttons and sliders.

Control Center can seem daunting at first; as it's more detailed than most iOS interfaces. But once accustomed, you'll find it very useful.

On the left are buttons and sliders for media playback (music and video). The top slider is the Playhead, which is used to control the position of a track or video; below that are the usual Play, Next and Previous buttons along with whatever song, audiobook or video is currently playing; below this sits a volume slider.

In the middle are five buttons that turn on and off key features: AirPlane Mode, Wi-Fi, Bluetooth, Do Not Disturb and Orientation Lock.

At the bottom are AirDrop and AirPlay buttons, both used to share items with other devices. On the right are shortcuts to the Timer part of the Clock app, and Camera. Finally on the bottom right is a slider for screen brightness.

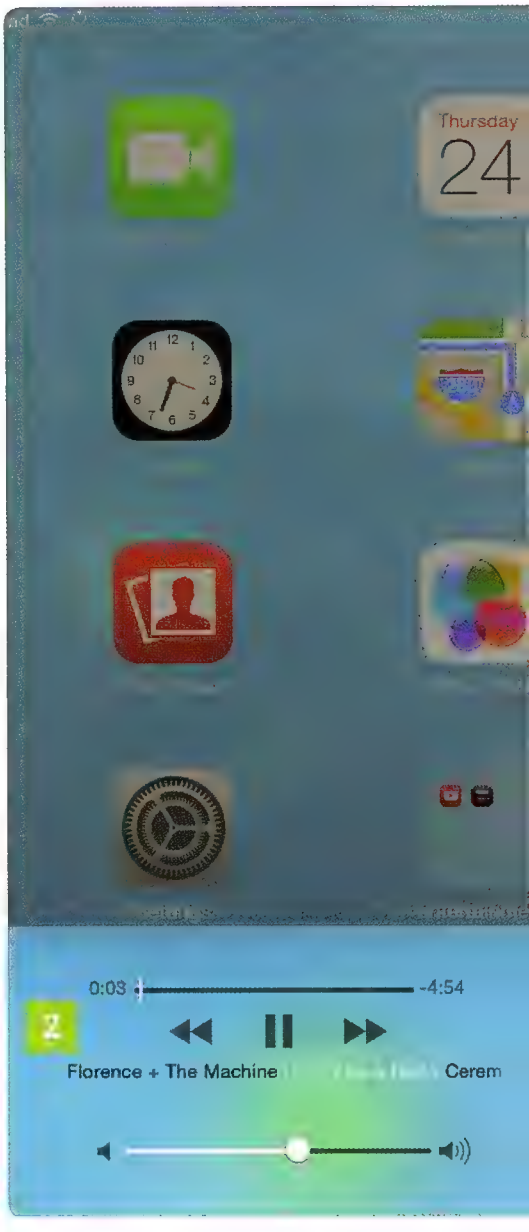
When you're done with the Control Center, you simply swipe back down to get rid of it. To begin with, Control Center seems a complex beast, but it soon becomes invaluable once you get to know it.

1 OPENING AND CLOSING

To access Control Center slide your finger up from the bottom of the screen. You can access the Control Center from just about any part of iOS, including inside apps. Sometimes apps use a similar gesture, in these cases you need to swipe up twice. The first slide will reveal a grey tab with an arrow facing up, the second slide then reveals Control Center. Slide down to remove it and return to the app or Home Screen.

2 MUSIC AND VIDEO

Control Center is in its element when it comes to controlling media. You use the controls just like you would inside music, to skip to the next or previous track, and use the Playhead to scrub through audio. The Volume control and Brightness on the right are useful for media playback. When music is playing the track will appear underneath the controls on the right, tap this to open the Music app.

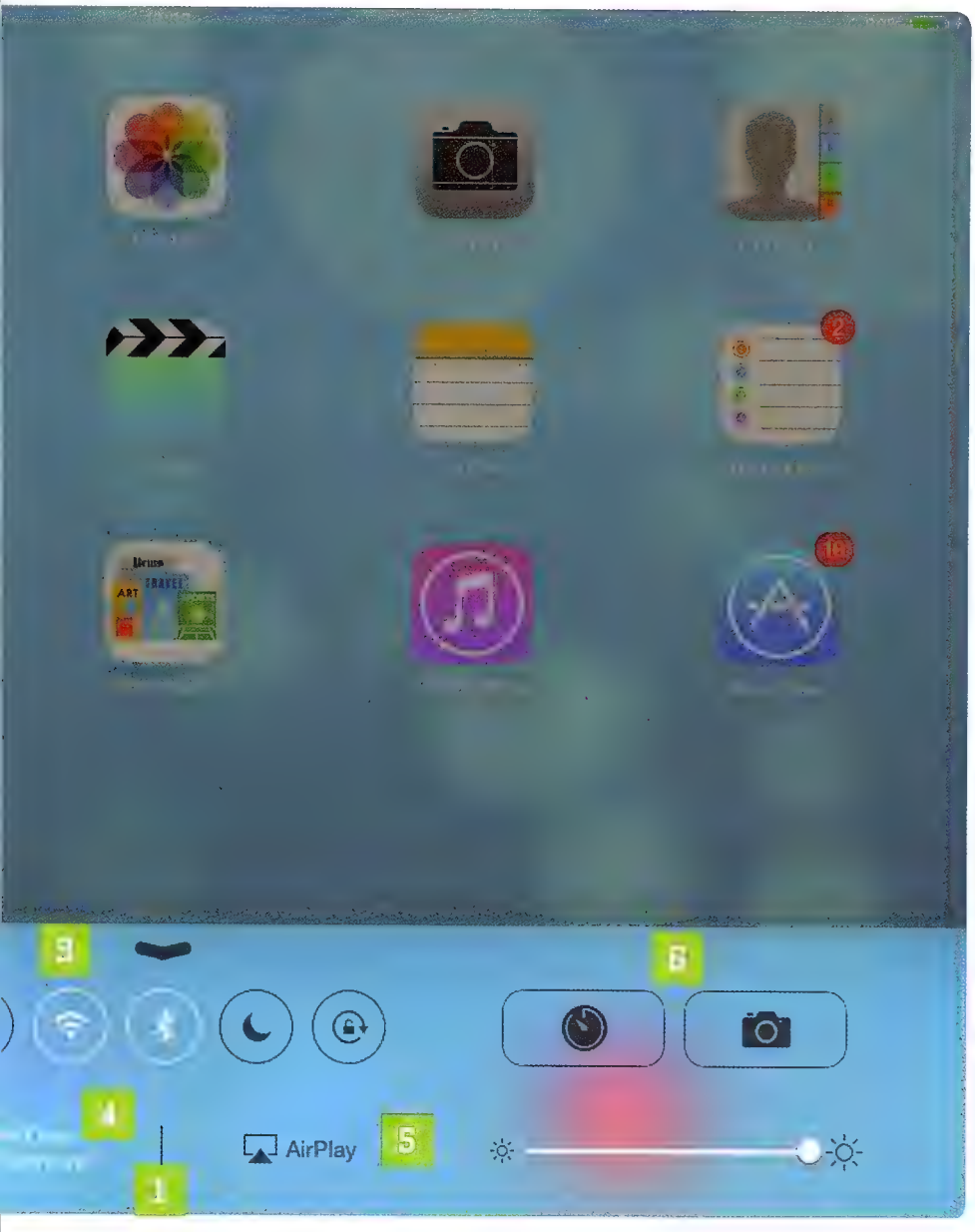


From the Lock screen

Control Center can be accessed from the Lock screen without entering your passcode first. This enables you to perform tasks like skipping music tracks, adjust volume and access the camera. Some features remain locked until you access the phone (you can't access your Photos through the Camera app, for example).

3 QUICK FEATURES

In the middle sit five buttons used to turn features on and off: AirPlay, Wi-Fi, Bluetooth, Do Not Disturb and Orientation Lock (to lock the screen in whatever orientation it is currently in: portrait or landscape). To turn a feature on, tap it and it lights up. We normally leave Wi-Fi on, and put Bluetooth on only when using a Keyboard or AirDrop. The other controls are turned on and off on an ad-hoc basis.



AirDrop with apps

AirDrop is a powerful new technology that is switched on using Control Center but used inside compatible apps. It uses both Bluetooth and Wi-Fi together to share files between iOS devices. If you want to share a photo with another person, open Control Center and tap AirDrop and Contacts Only (if you know them) or Everyone (if you don't). Open the Photos app and pick a photograph, then tap Share in the bottom left. The section marked AirDrop will show all the people in the local vicinity with AirDrop turned on, tap a person's name and the photo will be sent straight to their device.

4 TURNING AIRDROP ON

AirDrop is a fantastic new technology used by Apple to share files from one place to another. If you want to turn Airdrop on tap the AirDrop button at the bottom of Control Center. You can choose to share files with Everyone or Contacts Only (which limits it to people in your Contacts app). AirDrop uses both Wi-Fi and Bluetooth so turning on AirDrop automatically switches on both the features in Control Center.

5 USING AIRPLAY TO STREAM VIDEO

The AirPlay button is used to stream video with an Apple TV, and audio with an AirPlay compatible speaker. With the media already playing swipe up to access Control Center and tap the AirPlay button. Now choose the device you want the media to play from. You can also choose Mirroring On when using the Apple TV, this will share everything from your iPad display (such as the Home Screen and apps with the Apple TV).

6 QUICK APP ACCESS

To the right are two apps that you can quickly access with Control Center: Timer and Camera. Tapping timer opens up the Clock app in the Timer section, allowing you to quickly set a countdown. Use the barrel picker to set a time and tap Start. Tapping the Camera icon opens the Camera app, allowing you to take quick photographs. There are additional apps such as a Torch (using the LED light) and Calculator on the iPhone.

Trigger tasks with NFC

Simon Chester demonstrates how your Android phone or tablet's NFC radio can provide a simple way to perform complex tasks.

NFC is a technology that is yet to hit the mainstream, despite just about every new Android phone including the capability, and tags being available for about $1 each on eBay. I really like NFC, however, as it provides a method to quickly trigger a Tasker task.

Trigger a whatsa whoser? Trigger a task within the automation wünderapp, Tasker. My love for Tasker goes deep, as it pushes normally manual tasks into the background of your life. Very generally, it provides a middle-man that links events (like arriving home) to actions (like disabling your lock screen). This is just scratching the surface, however, and I'd really recommend taking a gander at the Tasker web site at **tasker.dinglisch.net**.

Tasker is made powerful through plugins, and you'll need one for it to work with NFC. The simplest of these is Tasker URL Launcher, which allows Tasker to respond to URLs in the form of 'tasker://taskname'. You can then use any NFC writer program (Tagstand Writer by Egomotion Corp is a good free one) to program in the URL. Sadly however, it doesn't work on JellyBean.

So, for those users on JellyBean or above, I recommend NFC ReTAG by WidgApp Mobile Solutions, as it offers some powerful features on top of the ability to launch Tasker tasks – including adding 'cycles' to scans, which will launch different activities depending on how many times its been scanned.

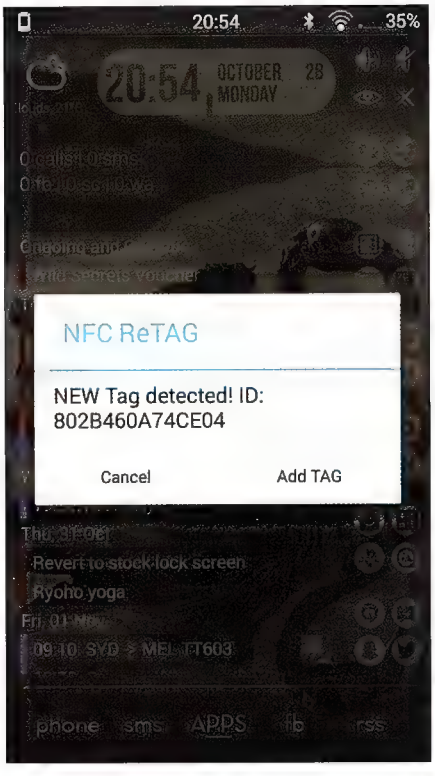
Outside of Tasker, NFC ReTAG can independently toggle things like Wi-Fi or Bluetooth, set alarms, start any app, and much more. So, if you're not interested in setting Tasker up (it has a bit of a learning curve), you can initiate many tasks from within NFC ReTAG alone – it even supports Wi-Fi and Battery status triggers as alternatives to NFC.

QUICKLY SHARE YOUR WI-FI PASSWORD

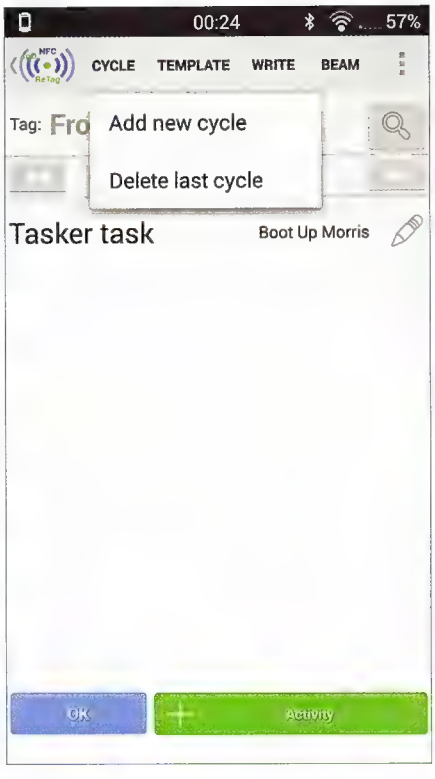
While NFC ReTAG's main feature is that it uses the unique IDs of tags to trigger tasks – allowing you to use any ol' write-protected NFC you have lying around, including hotel tags, price tags, or other cards – you can also use it to write app-specific commands to tags, allowing you to issue commands on your friends' phones (if they have NFC ReTAG installed – if they don't, they'll be redirected to its Play Store page). Perhaps the most convenient is programming in your highly-secure-but-difficult-to-type Wi-Fi password – a task that, surprisingly, isn't natively supported by Android.

To set up a Wi-Fi tag, scan a tag as usual, and add it to the NFC ReTAG database. Then name it, and press the '+ Activity' button > Wireless / Network > Add new SSID' and enter in your Wi-Fi details. Next, press the more button on the main screen of NFC ReTAG, and 'Write special NFC ReTAG tag'. Chances are that you want to choose the 'Adv. Version tag', so simply tap the tag to write it.

This is a handy feature, to be sure, but let's take a look at some of the fun things you can do when you start to invoke Tasker.

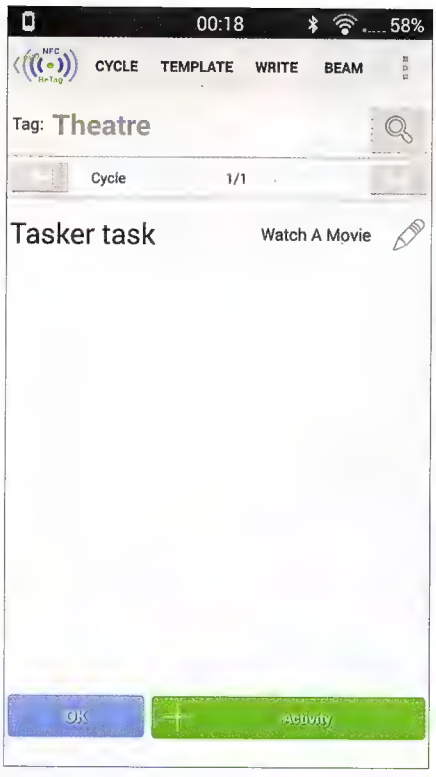


Scanning a blank tag will prompt you to add it to the NFC ReTAG database.

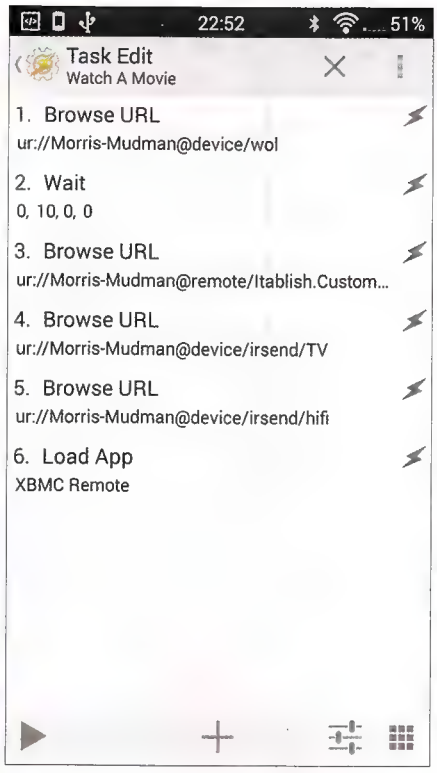


Cycles allow you to have NFC tags perform different tasks every second time (or more) they are scanned.

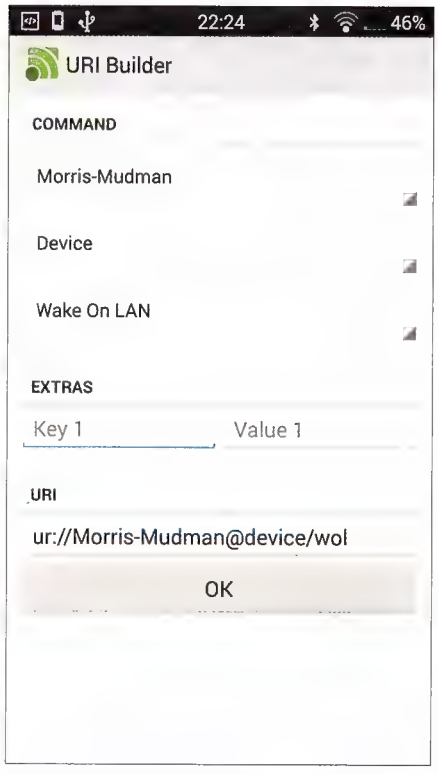
You can program in NFC ReTAG commands into tags so that other phones can use them, too.



Using NFC ReTAG to read tags and trigger Tasker tasks is where the fun begins.



A single NFC scan can trigger a chain of events in Tasker.



Unified remote allows Tasker to control your PC through the use of URIs.

ACTIVATE HOME THEATRE MODE

Try placing a tag near your couch that, when scanned, turns on your TV and Hi-Fi, wakes your home theatre PC (HTPC) from suspend and opens XBMC, then opens your remote control app of choice on your handset. Perhaps, if you own some home automation products, your curtains also close and your lights dim.

Setting this up requires the use of a few different apps: NFC ReTAG reads the tag, which tells Tasker to launch the 'Watch A Movie' task. This task tells Unified Remote (my PC control app of choice, see **www.unifiedremote.com**) to wake your HTPC, turn on your TV and Hi-Fi (using your phone's IR port or an IR blaster attached to your HTPC), wait the 10 seconds it takes to wake up, then launch XBMC. Now, while Unified Remote can control XBMC, the official XBMC control app does a better job, so Tasker launches that instead.

To have Tasker control Unified Remote, you need to pass it a specially formed URI. To find the URI for any command, from the remotes page in Unified Remote, hit the share icon, and choose URI (you'll notice that there is an option for NFC, which will then write this URI to an NFC Tag, but I prefer to handle everything in Tasker, as it makes it easier to stack tasks). Then select your server, the remote that contains the command, and finally, the command you need. Then copy this URI to your clipboard, and in your Tasker task of choice, create a new action of type 'Net > Browse URL', and paste in the URI that you just created.

ENDLESS POSSIBILITIES

This is just one function you can use NFC and Tasker to automate. Now that you have NFC integration into Tasker, start thinking about all those places where you regularly perform some task on your phone – then replace them with a sticker.

For example, place a sticker on the back of your handset's car cradle to activate Bluetooth, start some music, and open your navigation app.

Own a Pebble smartwatch? The excellent PebbleTasker app allows you to program the three buttons on your watch to launch certain Tasker tasks, depending on context. I use this with a tag by my front door so that, when I scan it, my PC boots up, my Pebble watch is switched to the interface to control my SqueezeBox music players (random album/song, next/prev track, play/pause all at the push or hold of a button), and my phone's ringer volume reduces and lock screen disables. When I scan it as I leave, the tag's alternate 'cycle' stops all music, shuts down my PC (via Unified Remote), and ups my ringer volume and re-activates my lock screen.

What you can achieve with NFC + Tasker is, to use the cliché, only limited by your imagination and your patience in setting it up. I highly recommend checking out the guides at **tasker.dinglisch.net/guides.html** to fully appreciate just what's possible.

NFC with your screen off

For reasons of security and battery prudence, Android will only allow you to scan NFC tags when your screen is on and your device unlocked. Thankfully, you can circumvent this limitation through the use of an Xposed module called LockScreenOff Enabler. To learn more about Xposed, visit **forum.xda-developers.com/showthread.php?t=1574401**. Advanced users will be pleased to know that it can pass intents to Tasker, which tell it not only when a tag is detected, but when your phone is removed from it. This is especially handy for when you place your phone onto — and later remove it from — your car dock or bedside table.

Create a totally custom Linux desktop

Yes, you can create a highly customised, low-resource desktop environment without a single line of source code. Mike Saunders explains how.

Titlebars, launchers, panels, notification areas, background images – these are all things we expect in any modern desktop environment. Usually, these features are provided by individual programs, so if you're running Xfce and enter `ps ax` in a terminal, for instance, you'll see xfwm for the window manager, xfce4-panel to provide on-screen panels, and so forth. If you start terminating these programs, bits of your desktop environment will start to disappear from the screen. KDE and Gnome work in a very similar fashion.

Now, this is all good and well, but we're Linux geeks, right? The defaults do an adequate job, but we run this OS so that we can customise it to our hearts' content, rip out bits we don't like, and explore the inner workings of the system.

KDE, Gnome and Xfce look like hugely complicated beasts, but they're really just a series of programs started in sequence. You can replace these programs individually, or you can choose your own combination of window manager, panel, workspace switcher and so forth – and that's exactly what we're going to do in this how-to.

There are many lightweight window managers out there that offer the bare minimum of functionality, so other developers have written the extra components you need to create a fully-fledged desktop environment. We'll explore the different choices available, and then show you how to piece them all together into a custom desktop.

If you're running KDE, Gnome or Xfce, you'll find that the result is a much snappier and less memory-intensive experience. But most importantly, when your fellow Linux users are talking about upgrading to the latest KDE or Gnome, you can wave your hand and say: "Pfft! Those are old-hat. I made my own desktop environment last night, and I'll install it for you if you like." Geek points are coming your way...

Adding window managers via your package manager should create new login screen sessions – but we'll also show you how that works.

CHOOSE A WINDOW MANAGER

By far the most important component is the window manager. This (normally) provides titlebars so that you can move windows around on the screen, along with buttons to perform actions on the window – maximise, close, etc. The WM also (normally) adds handles to the edges of windows for resizing. Without a WM, your applications could still run, but you wouldn't be able to move them around or resize them. There are some novel window managers that take different approaches, such as automatically arranging windows into grids (tiling WMs), and they don't need titlebars.

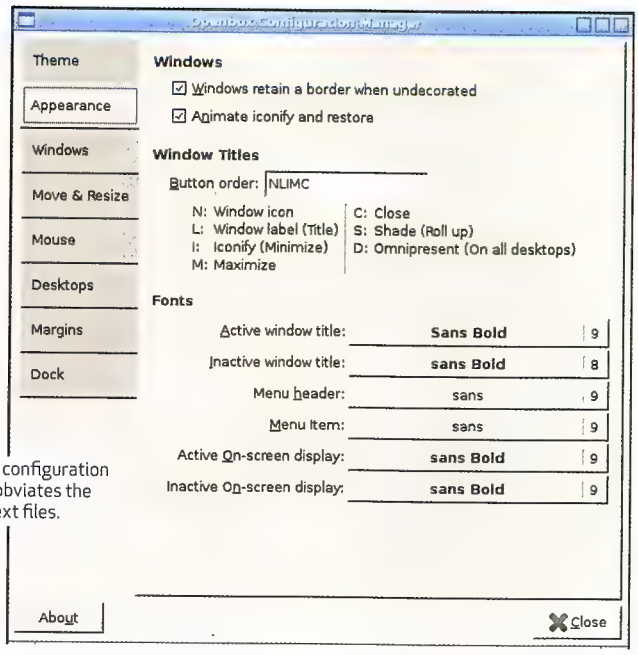
Here, we'll describe some of the best choices and explain how to use them. If you install them via your distro's package manager, you should be able to log out of your current session and choose them in your login screen. If you don't see an entry for your WM of choice, try selecting a fallback/terminal option in the login screen; some distros provide this. You'll see an empty terminal window and you can enter the appropriate command to start the WM, as described below.

If you can't get the WM to start at all, worry not: we'll show you how to create a new login screen session later on.

» **Name: JWM**
» **Web site: joewing.net/projects/jwm/**
» **Command to start: jwm**

JWM is very bare-bones, being written in C and only making use of the core X libraries as dependencies. Consequently, it's screamingly fast. JWM has a fairly usable default panel, containing a program menu, workspace switcher and taskbar, but you'll probably want a more featureful panel from the options we'll look at later.

By default, the program menu (also available by left-clicking on the desktop) contains only entries to start a terminal, lock the screen and log out – you can customise this by editing /etc/jwm/



Openbox has its own configuration tool (obconf), which obviates the need to fiddle with text files.

system.jwmrc (or /usr/local/etc/jwm/system.jwmrc if you built it from source).

This XML-based configuration file is easy to understand, and via it you can also customise the WM's fonts and keybindings.

» **Name: Openbox**
» **Web site: www.openbox.org**
» **Command to start: openbox**

Openbox is part of the 'box' family of window managers, which includes Fluxbox and Blackbox (the original, from which the others are derived). It's perhaps the most popular low-fat window manager, and is used in the LXDE desktop. Openbox's default configuration is as bare-bones as it gets: as soon as you start it, you'll see a grand total of nothing. Just your mouse pointer in the middle of the screen.

Right-click, however, and a small menu will pop up, from which you can open a terminal window, launch a web browser, or run the configuration tool. It's this tool that makes Openbox our favourite choice for custom desktop environments, because you can configure almost everything in the window manager without having to poke around inside text files. Plus, while Openbox is very limited on the feature front, it's highly standards-compliant and interacts excellently with other tools.

The keyboard shortcuts are typical: Alt-Tab to cycle through windows, Alt-F4 to close programs, and Ctrl-Alt-Left/Right cursor keys to switch between different virtual workspaces.

» **Name: Ratpoison**
» **Website: ratpoison.wxcvbn.org**
» **Command to start: ratpoison**

Here's a very different kind of window manager: it's built around a concept called 'tiling'. Instead of the usual system of draggable windows that can overlap one another, in Ratpoison windows are allocated areas on the screen. It takes a while to get used to, but as you learn the keybindings used to manage windows, you become less and less dependent on the mouse (hence the name).

On first start, Ratpoison is completely bare, and you'll find that the mouse does nothing. Hit Ctrl-t followed by !, though, and a tiny box will appear in the top-right corner, which lets you enter a command (eg, `xterm`). When you launch a program, by default it will appear in full-screen mode, and once you have multiple windows open, you can switch between them using Ctrl-t, followed by n and p (next and previous). Enter Ctrl-t-w to show a numbered list of windows and Ctrl-t followed by a number to switch to a specific window. Now, the real fun begins in tiling mode. With a few windows open, hit Ctrl-t s to split the screen vertically into two zones, called frames. The current window will appear in the top frame, while the previous window will appear underneath. Hitting Ctrl-t, followed by S (capital letter) splits the screen horizontally. This is excellent if you have a large and high-resolution monitor, as you can, for instance, create a large frame for your web browser, and have a couple of smaller terminal windows sitting next to it.

To switch between frames, hit Ctrl-t, followed by the cursor keys (eg, the down key to switch to the frame underneath). You can make a frame full-screen again with Ctrl-t-Q. For a full list of keybindings, enter Ctrl-t-?, and visit the Ratpoison wiki at **tinyurl.com/obcarv5** for details on more features in the WM.

Other window managers worth looking at include Sawfish (**sawfish.wikia.com/wiki/**), WindowLab (**nickgravgaard.com/windowlab/**) and Pekwm (**www.pekwm.org**).

Talking the same language

It's no coincidence that all these tools can work together. Critics accuse the Linux desktop of being a mish-mash of old and new technologies, with little binding them together, but that's not fair. Sure, there's a lot of old code still around, but programs work together thanks to standards. EWMH, the Extended Window Manager Hints specification, "defines interactions between window managers, applications, and the utilities that form part of a desktop environment". In other words, it lets these components share information, providing a more cohesive experience. A good example is workspace switchers: they often show miniature thumbnails of the workspaces and the windows in them. Usually, you want only to see application windows in these thumbnails, and not the usual desktop furniture. Thanks to EWMH, a panel or a window manager can tell a pager that a window isn't meant to be displayed in the thumbnails. See **standards.freedesktop.org/wm-spec/wm-spec-latest.html** for the full spec — it's a long read, but essential if you fancy writing your own WM.

CHOOSE A PANEL

So, we have the job of managing windows sorted out. Now we want a panel for launching programs, switching between windows and workspaces, showing a clock and so forth. As mentioned, JWM includes a simple panel, but we'll look at some more featureful options here.

» **Name: Docky**
» **Web site: www.go-docky.com**
» **Command to start: docky**

We absolutely love the description on Docky's web site: "If there ever was something made of pure awesome in the history of mankind, then its name is Docky". And, you know, we can't really disagree – it's very cool indeed. Docky is fairly heavy for a panel, with a lot of dependencies, so if you're creating a custom desktop for low-memory machines it's best to try the other options. You should be able to find Docky in most distros' package repositories (it's just a `sudo apt-get install docky` away in Ubuntu-based distros), and when you start it, you'll see a small black panel at the bottom of the screen. There's a single static icon that shows an anchor – this

opens up the Settings dialog. From here, you can choose Panel mode, which extends Docky to fill the width of the screen, and change the theme (some of them are truly gorgeous). Switch to the Docklets tab of the Settings dialog to add other static items to the panel, such as a clock, workspace switcher and battery monitor.

Docky doesn't include a main menu, which is a bit limiting, but if you start programs via your window manager you'll see icons for them appear on the panel. Right-click on an icon and choose 'Pin to dock' to make the icon remain in the panel, even when you close the program. In this way, you can populate your panel with your most-used programs, so the lack of a main menu isn't a huge deal.

» **Name: Cairo-Dock**
» **Web site: glx-dock.org**
» **Command to start: cairo-dock**

If you want eye candy, Cairo-Dock delivers it in spades. Its 3D Plane view is strikingly similar to Mac OS X's dock, with lush reflection effects and patterned lines separating different areas. Icons grow in size as you run the mouse pointer over them, and if you hover over a folder, a preview of its contents springs up onto the screen. The whole thing is really beautiful – but it requires some oomph from your graphics card, of course.

Unlike Docky, Cairo-Dock does include a main menu based on system settings; in other words, it'll show the same items that you see in other window managers and desktop environments. You can right-click on any item to configure it, or go into 'Cairo-Dock > Configure' to customise the panel itself. And it's immensely configurable, with plenty of add-ons to enable, keybindings to tweak and size and position settings to change.

» **Name: WBar**
» **Web site: code.google.com/p/wbar/**
» **Command to start: wbar**

This is the lightest of the three panels covered here, and starts up almost instantly. It features a transparent background, animated growing icons when you mouse over them, and a graphical configuration tool (install wbar-config alongside the panel itself). By default, it's displayed vertically, but you can click on the top-most icon to change this, along with other settings.

Add and remove launchers via the Icons tab, and if you want the panel to act more like a taskbar, there's an option for this under the Preferences tab. To customise the zoom levels, transparency effects and distance between icons, see the Effects tab.

If none of these docks float your boat, try tint2 (**code.google.com/p/tint2/**), PerlPanel (**savannah.nongnu.org/projects/perlpanel**) or the Avant Window Navigator (**launchpad.net/awn**). The last two are a bit dated now, but you can still find packages for various distros on the net.

CHOOSE SOME EXTRAS

Most lightweight window managers don't include any way to set the desktop background image, so you'll need another tool for that. hsetroot is a simple little program that's available in most distros as a standalone package, or occasionally as part of HackedBox (another small WM). Once you have it installed, using it is as simple as:

```
hsetroot -full /path/to/image.jpg
```

That places the full image on the screen, without any changes. Other options include `-center`, `-tile` and `-fill` (to stretch it). You can also use PNG images and other formats.

If your choice of dock or panel doesn't include a virtual workspace switcher, you'll need to get a standalone one. There isn't a massive variety of choices in this area, but the one we recommend (because its dependencies are minimal and it works almost everywhere) is NetWMPager. Go to **tinyurl.com/k6ks4ac** and grab the latest source code (2.04 at the time of writing) and build it like this:

```
tar xfv netwmpager-2.04.tar.bz2
cd netwmpager-2.04/
./configure
make
sudo make install
```

If you encounter an "undefined reference to symbol XGetWindow Attributes" problem after the make step, edit config.mk and change the XFT_LIBS line so it reads like this:

```
XFT_LIBS = -lXft -lX11
```

Save the file and run the last two steps again. Now you can start it with `netwmpager`, and you'll see a pager window showing desktops in the bottom-left corner.

By default, it's very small and auto-hides; to change this, edit /usr/local/share/netwmpager/config-example and modify the geometry and auto_hide lines. If you need a notification area (aka system tray), Stalonetray is a fine example. It's available in Ubuntu's package archives and also via source code at **stalonetray.sf.net** – if you're compiling it by hand, extract it and run the ./configure, make and sudo make install steps as above.

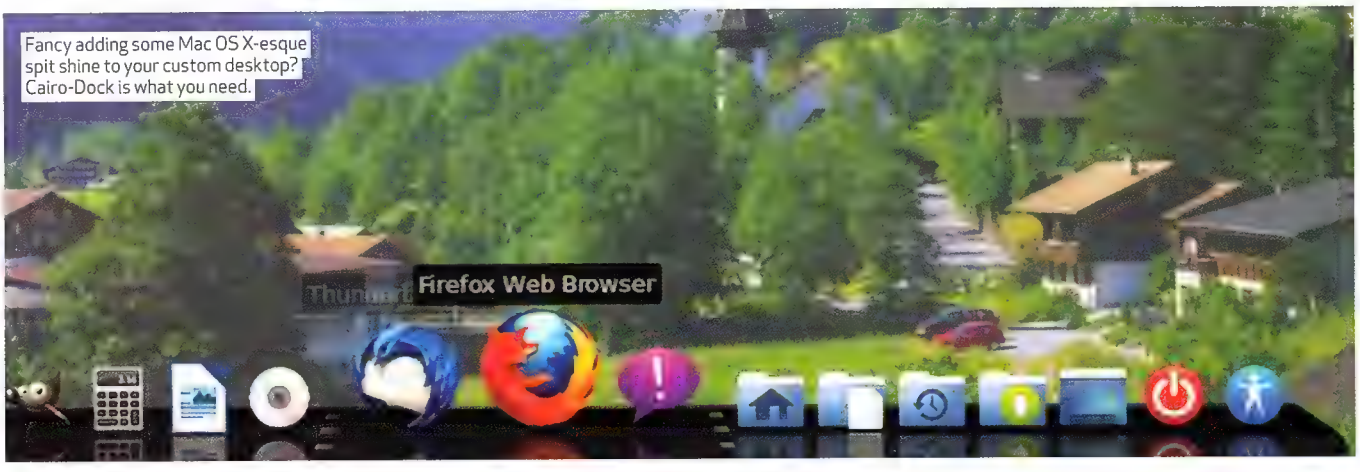
Then launch it like so:

```
stalonetray -geometry 5x1+50+20
```

This creates a notification area five slots wide by one slot high, 50 pixels across and 20 down (from the top-left corner of the screen). You can, of course, make it any size and place it wherever you want.

PUT IT ALL TOGETHER

Now we can put the components together, and make a desktop environment. You can use any combination of the previously mentioned programs; in our case, we'll use Openbox, Docky, hsetroot, NetWMPager and Stalonetray. The first thing to do is to create a script that launches the required programs. For our custom desktop, we're putting this in /usr/local/bin/mikedesk-start:



Fancy adding some Mac OS X-esque spit shine to your custom desktop? Cairo-Dock is what you need.

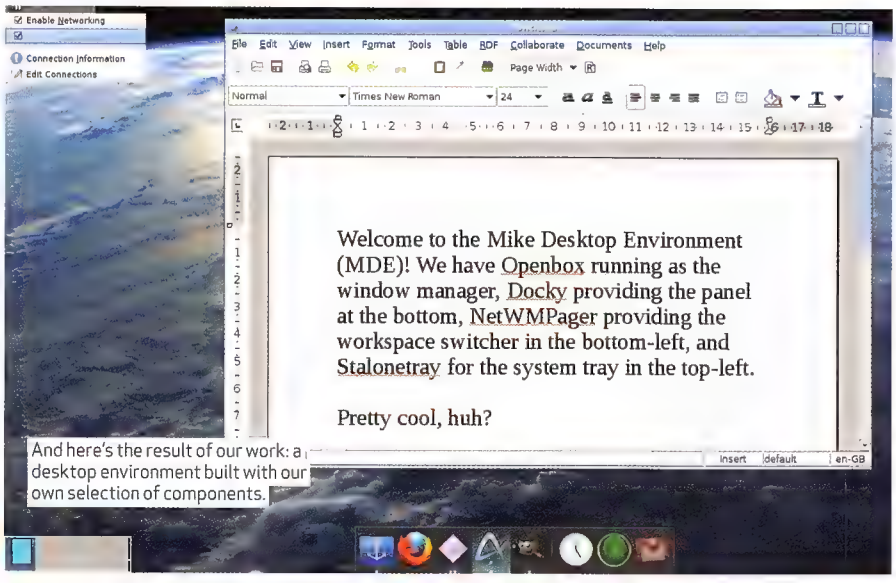
```
#!/bin/bash
docky &
hsetroot -fill /usr/share/
backgrounds/space-02.jpg &
netwmpager &
stalonetray -geometry 5x1+0+0 &
openbox
```

The & after the commands here means 'run them in the background' – ie, so they can all run at the same time, and don't wait for each other to finish. It's important that your window manager goes on the last line, without the &, otherwise the session will close immediately.

Save the file and make it executable (eg, `sudo chmod +x mikedesk-start`). The next step is to create a login screen session, so make a new file called something like /usr/share/xsessions/mikedesk.session with the following contents, customised for your setup:

```
[Desktop Entry]
Name=MikeDesk
Comment=Mike Desktop Environment
Type=XSession
Exec=/usr/local/bin/mikedesk-
start
TryExec=mikedesk-start
```

Save it, log out of your current session and you should see a new one in your login manager. Choose it, log in and enjoy the fruits of your labour. Congratulations, you are now officially awesome.


Welcome to the Mike Desktop Environment (MDE)! We have Openbox running as the window manager, Docky providing the panel at the bottom, NetWMPager providing the workspace switcher in the bottom-left, and Stalonetray for the system tray in the top-left.
Pretty cool, huh?
And here's the result of our work: a desktop environment built with our own selection of components.

Help! My Gtk and Qt apps look rubbish

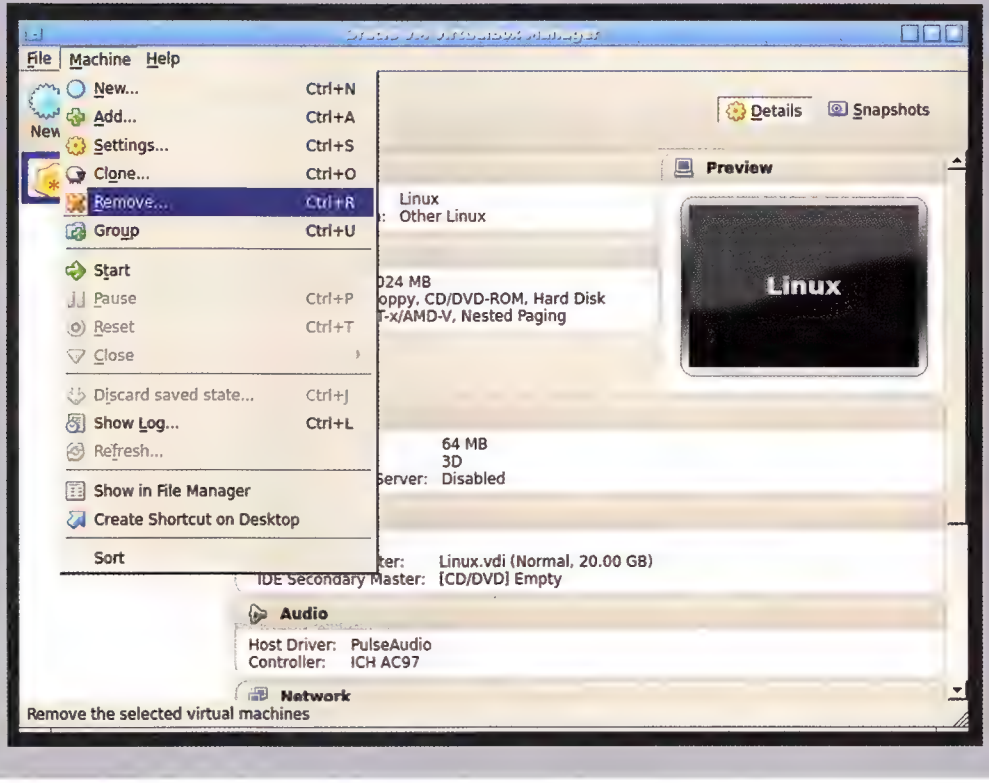
This, unfortunately, is a common problem when switching to another window manager. You set up everything perfectly, install a great theme, choose a dazzling desktop wallpaper, and then… Your Gtk and Qt applications look like something out of the 1980s. Flat menus, blocky widgets, dark grey backgrounds and ugly fonts — it's almost like a joke. Gtk and Qt can no longer determine which theme to use, so they go with the ugly built-in defaults. If you're running Gnome or Xfce, Gtk apps can ask the desktop to provide theme information, but with a standalone window manager these toolkits need to rely on configuration files. For Gtk, there are a few options; it's best to try a combination. `gtk-chtheme` lets you set the theme used by Gtk 2.x applications, but not 3.0. For the latter, edit ~/.config/gtk-3.0/settings.ini so that it specifies the theme name:

```
[Settings]
gtk-theme-name = Clearlooks
gtk-fallback-icon-theme = gnome
```

If neither of these have the desired effect and you have Gnome installed, try running `gnome-settings-daemon`. That will re-theme running Gtk apps using the settings specified in Gnome, but it will also reset your desktop wallpaper. For Qt, you have two options: to force Qt apps to use Gtk themes, edit ~/.config/Trolltech.conf and add this:

```
style=GTK+
```

Alternatively, install the qt4-qtconfig package and then run `qtconfig`.



Here's how VirtualBox (a Qt app) looks with Qt's default theme – it's like Windows 95, all over again.

Control charts with macros

Helen Bradley teaches you how to change the data plotted on a chart using option buttons and some simple macros.

Get it
Download the macro you need for this article from www.apcmag.com/magstuff.htm

Excel's ActiveX controls can be used to control what is plotted on a chart when you combine them with some simple macro code. We'll show you how to create a solution using ActiveX controls which changes the data being plotted on a chart each time an option button is clicked.

CREATE THE WORKSHEET

To get started create your data in a range five columns wide and four rows deep – use cells A3:E6. Place the column headings in row 3, the row headings in column A and values in the range B3: E6.

Select the range A3:B6 and create a column chart from this data. Right click the chart's Y-axis, choose 'Format Axis' and set the Maximum value to the maximum value in your data range rounded up to the next Major Unit.

To create the option buttons, first ensure that the Developer tab is visible on the Ribbon – if not, choose 'File > Options > Customize Ribbon' and check the Developer checkbox in the right hand panel. Click 'Design Mode', click Insert and add four Option Button (ActiveX Controls) – don't use the Form Controls.

Select each option button in turn, click Properties and set each button's Caption property to one of the four column headings. Set the Value property of OptionButton 1 to True then double click it to open the Visual Basic Editor.

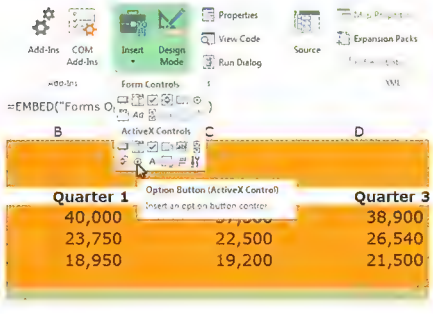
Add this code to the module:

```
Option Explicit
Public chartName As String
Public dataRange As String
Private Sub OptionButton1_
Click()
    chartName =
"=Sheet1!R3C2"
    dataRange =
"=Sheet1!R4C2:R6C2"
    changeChart chartName,
dataRange
End Sub
Private Sub OptionButton2_
Click()
    chartName =
"=Sheet1!R3C3"
    dataRange =
"=Sheet1!R4C3:R6C3"
    changeChart chartName,
dataRange
End Sub
Private Sub OptionButton3_
Click()
    chartName =
"=Sheet1!R3C4"
    dataRange =
"=Sheet1!R4C4:R6C4"
    changeChart chartName,
dataRange
End Sub
Private Sub OptionButton4_
Click()
    chartName =
"=Sheet1!R3C5"
    dataRange =
"=Sheet1!R4C5:R6C5"
    changeChart
chartName, dataRange
End Sub
Sub changeChart(chartName
As String, dataRange As
String)
    ActiveSheet.
ChartObjects(1).Activate
    ActiveChart.ChartArea.
Select
    ActiveChart.
SeriesCollection(1).Values =
dataRange
    ActiveChart.
SeriesCollection(1).Name =
chartName
    Range("A1").Select
End Sub
```

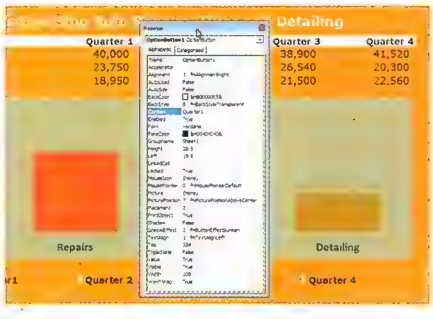
Save the code and return to Excel. Click 'Design Mode' again to disable it so you can test the macro. Click each option button in turn and, when you do so, the chart name and the range plotted will change accordingly.

When an option button is clicked the macros store new values for the range containing the chart title and the range to be plotted in two public variables. These values are then passed to a subroutine which activates the chart and sets the title and plotted series to these new references.

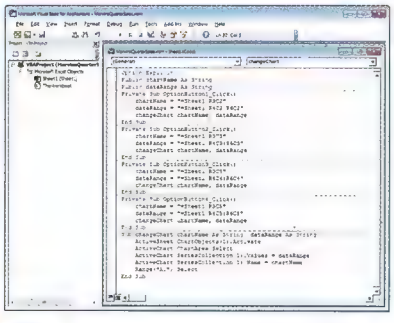
Step-by-step: ActiveX controls



1 On the Developer tab, select 'Design Mode' and insert the ActiveX Option button controls. Size and format them as desired.



2 The Properties panel contains properties such as Caption and Value as well as formatting properties used to format each control.



3 Double-click an Option button to open the Visual Basic Editor and then type the macro code.

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A Haswell-based budget box

We all know AMD makes some damned-fine budget parts, but can Intel compete? This month, Tom McNamara builds a $863 Core i5 Haswell rig to find out how it stacks up.

The mission here in the PC builder section of the mag, is it seems like whenever we build a high-end system it's powered by an Intel CPU, and budget systems always run AMD parts. This month, we're flipping the script and building a budget-oriented Intel system to see how it compares to AMD's offerings, and to give people a glimpse of what a $850-odd Intel rig can throw down.

For comparison's sake, we recently specced up budget rigs using AMD's new Richland APU as well as one with a $120 Vishera FX-6300 CPU, and found that both chips serve their niche quite well. For this Intel build, we knew we'd go with Haswell, and wanted to run a Core i3 CPU, which typically comes with two cores and Hyper-Threading (HT), but those haven't been released yet. So, the next-best CPU we could get was the Core i5-4430 – a quad-core CPU without HT for $230. That's almost a third of our budget on the CPU, which forced us to be frugal elsewhere. We also took this opportunity to try out a new microATX case from Cooler Master that retails for $50, which we felt was perfect for a budget build.

GATHERING INTEL

Since we're working on a tight budget, we planned this system to be relatively bare-bones, thus allowing us to build inside the smallish Cooler Master N200 microATX chassis. This is a chassis that's smaller than a traditional mid-tower, but larger than a traditional small-form-factor case, with plenty of room for cables and extra-long GPUs. The foundation for our build would be a motherboard from Gigabyte, the GA-B85M-D3H (not to be confused with the HD3). It has a fat heatsink on the parts that usually get pretty hot, so we figured the board would be relatively stable. Other than that, it is a budget B85 board, with four SATA 6Gbps ports, Realtek integrated sound, one PCI Express 3.0 slot, and four RAM slots that can handle up to 32GB clocked at 1,600MHz. It also features Gigabyte's DualBIOS feature, so the motherboard can use the backup BIOS if the primary one fails to boot. The Core i5-4430 isn't overclockable, so we won't be messing with any of that. Although the Core i5-4430 is about $30 more expensive than the A10-6800K that we've used in an AMD budget build, that CPU also wore a Cooler Master Hyper 212 Evo cooler, which comes out to... about $30. So it's the same difference in the end, though CPU and integrated graphics performance will differ.

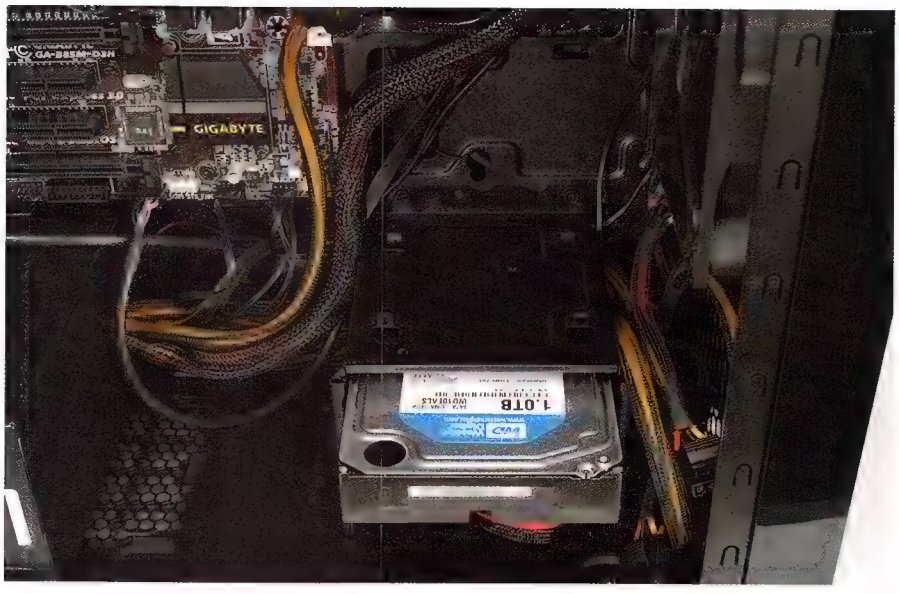
Other than that, we're trying to keep the rest of the system similar to some of our previous budget builds, so you may see some familiar parts in the Kingston SSD, Corsair power supply, 1TB hard drive, Windows 8, and optical drive.

LABS BENCHMARK RESULTS

	PART	PRICE
CASE	Cooler Master N200	$50
PSU	Corsair CX500	$85
MOBO	Gigabyte GA-B85M-D3H	$95
CPU	Intel Core i5-4430	$230
COOLER	Intel stock cooler	N/A (bundled)
GPU	Intel HD 4600	N/A (integrated)
RAM	2 x 4GB Corsair Vengeance LP	$130
SSD	60GB Kingston SSDNow V300	$80
HDD	1TB Seagate Barracuda	$68
OPTICAL DRIVE	Samsung SH-S223	$35
OS	Windows 8 64-bit OEM	$90
TOTAL		$863

STATING YOUR CASE

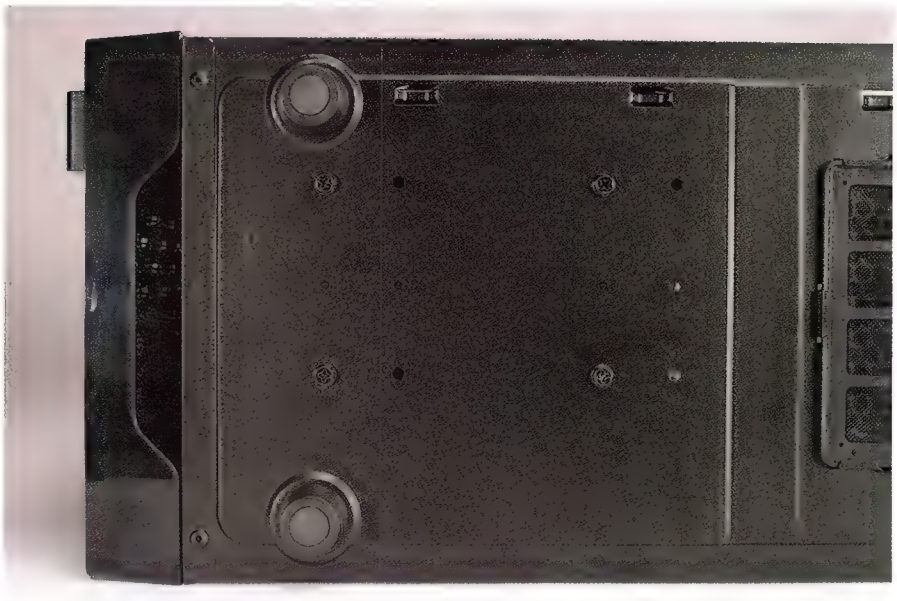
The N200 case is about 20cm wide, so cable management quickly becomes an issue as soon as you begin inserting parts. As we began building, the first area of trouble we ran into was with the hard drive cage on the bottom of the chassis, which holds two 3.5-inch drives and one SSD. If we were to use the standard screw holes for the hard drive, it would have given us very little clearance to connect the SATA and power cables on the other side. So we moved the HDD forward by one hole, which gave us some extra space in the back, making it easier to store unused power supply cables out of sight. It's a shame the hard drive cage doesn't have rails, as installing drives is a pain.



GETTING CAGEY

In order to install hard drives into the included cage, you need to attach screws to both sides of it, but there's no way to access the cage's left side with it inside the system, so you have to remove it altogether first. To do that you need to remove two screws that secure it to the motherboard tray, then flip the case on its side to access four more screws underneath the case (pictured). With those removed, you can pull out the cage and access the holes on its left side.

There are also four built-in SSD installation points – one on top of the lower HDD cage, two on the mobo tray, and one beneath the upper 3.5-inch drive bay – but we used an adapter bracket to install our lone SSD in the 3.5-inch cage. Call us old-fashioned, but we felt it offered the cleanest wiring options. The upper 3.5-inch drive bay also holds a single drive, so despite the N200 being only an mATX case, you have plenty of options when it comes to storage.



INTERCEPTING CABLES

A modular power supply probably would have been easier to use in such a small case, but we used the same PSU from an earlier Richland build, so we had no choice but to find room for all the cables. The side panels each have a bulge to them, but they're not deep enough to squeeze a 24-pin power cable behind the motherboard tray. There's also no cutout for the 8-pin power cable, so we had to route it over the motherboard like in the old days. Since there's no window on this case, we didn't feel too pressured to make the inside look pretty, but we did break out the twist ties in a few places.

LASER VISIONS

Optical drives are still the easiest way to install Windows, so we'll continue to use them until we're pulling an OS from the cloud. Plus, some motherboards don't play nice when you try to boot from a USB stick, especially if it's a USB 3.0 device. To install an optical drive with this case, you need to remove the front bezel via a hidden handle at the bottom that pulls outward. Once it comes off, you squeeze two tabs on the drive bay cover to remove it. You can see from the photo that the entire front of the case is just one big mesh grill. It holds two 120mm fans, or a 240mm radiator on the inside of the chassis. Though we didn't install a closed-loop cooler this time, it certainly can be done, but it makes for a very crowded interior. Once you put the front bezel back in place, smack it in each corner nice and hard.

ERROR CODES

We use a variety of monitors around the Lab, and during this build we happened to spot an unused 30-inch Dell with a resolution of 2,560 x 1,600 looking at us longingly. We thought it would be fun to test the system at that resolution, so we hooked it up only to find that we'd made a small oversight. The DVI connection on the back of this particular motherboard does not support dual-link DVI, it's single-link only. To distinguish the ports visually, DL has more pins in it – 24 as opposed to single-link's 18. You need dual-link to get a 60Hz refresh rate at resolutions above 1080p. DisplayPort accomplishes this objective as well, but this board did not have that connector either, leaving us stranded on 1080p island. D'oh! For what it's worth, you can get a motherboard in this price range with dual-link DVI, such as the MSI H87-G43, but that board has one less fan header than this Gigabyte board. Those fan headers come in handy, too, because this case has three fan mounts unused right out of the box, on the top, side, and front. The top even accepts 140mm fans, and the case comes with anti-vibration grommets.

LOOSE ENDS

Once we had mostly finished our build, we had to find space in the chassis to stash all of our cables, which is tricky in a case this size. Even cables that are in use need to have their middle parts tucked away. By moving our hard drive forward a bit in its drive cage, we were able to free up space behind it, into which we stuffed a lot of cables. We also took advantage of the small gap between the drive cage and the front of the case. Ideally, we would have spread these cables out behind the motherboard tray, but the side panels only bulge a few millimeters, and it didn't seem worth it to squeeze the cables that much just to clean things up, especially when there's no case window.

One slick feature of this chassis is that the internal 120mm intake fan can be moved to the outside of the case, where it sits behind the front bezel. This is handy if you're trying to set up a push-pull configuration on a radiator mounted inside the front of the case, though you'd need to remove the hard drive cage to accommodate such a setup.

1 The top fan mount has a pre-installed dust filter. It's attached by four plastic plugs that pop off easily.

2 The intake under the power supply also has a dust filter. It slides out from the rear for easy cleaning. The PSU area sports rubber anti-vibration feet.

3 The N200 has a decent amount of drive bays, but unfortunately none of them are tool-less. Drive installation is more difficult than it should be.

4 If you want to install a 240mm radiator in the front, you can squeeze its fans into the bezel. Otherwise, the drive cage needs to be removed.

BACK TO THE HASWELL

Building systems in these small cases always poses challenges, but it wasn't too bad this time around. It was a bit time-consuming to install the SSD and HDD, since the drive cage had to be removed, but the rest of the build was fairly painless. Once it was up and running, we were surprised by how quiet it was, despite the front of the case being nothing but mesh. You'd think some noise would leak through there, but the system was just about silent, even under full load. In fact, one time it ran for a minute or so without the CPU fan even spinning (the fan cable got caught in the blades, before we secured it with a twist tie). The case fan cables are also about 45 centimetres long, so they'll reach all the way from one end of the N200 to the other.

In terms of general desktop performance, we already had a good idea of what to expect since we had already tested Intel's Haswell CPU (see the August issue, page 42). In testing, the Core i5-4430 was able to encode videos and render hi-res panorama photos much faster than a comparably priced AMD CPU. Even when we overclocked the AMD 6800K to 4.7GHz, it couldn't keep up with a Core i5-4430 running at 3GHz.

The same can't be said for its gaming performance, though, as AMD clearly takes the crown from Intel. In general, Haswell's HD 4600 graphics are around 40 percent slower than the AMD 6800K's graphics. Then again, the Core i5-4430's non-GPU performance outclasses either AMD chip.

In the end, going Intel or AMD at this price range really comes down to what your needs are. You can get an FX-6300 for about $120 right now and add a Radeon HD 7770 for about $90 (if you're prepared to shop around). So, for gaming on a budget, AMD arguably provides the best value. If you're editing HD videos and hi-res photos, though, Intel wins by a comfortable margin.

All in all, the Intel system put up a heck of a fight against the AMD builds, at least in the computing realm; not so much in gaming. The system was fast enough for basic needs though, and if we had used a motherboard with DisplayPort and/or DL-DVI, we could call this build an all-around success.

LABS BENCHMARK RESULTS

Cinebench 11.5	ZERO POINT	
STITCH.EFX 2.0 (SEC)	1710	1135
PROSHOW PRODUCER 5.0 (SEC)	1947	1685
X264 HD 5.0 (FPS)	9.0	11.65
3DMARK11 PERFORMANCE	1668	1237 (-26%)
STALKER: CALL OF PRIPYAT (FPS)	8.3	8 (-3;5%)

0% 10% 20% 30% 40%

OUR COMPARATIVE RICHLAND SYSTEM ('ZERO POINT' ABOVE) WAS A QUAD-CORE 4.1GHZ A10-6800K AT 4.7GHZ, 8GB OF KINGSTON DDR3-1600, ON A GIGABYTE GA-F2A85X-D3H MOTHERBOARD. IT RAN RADEON 8670D INTEGRATED GRAPHICS, A MUSHKIN CHRONOS SSD, AND WINDOWS 8 64-BIT.

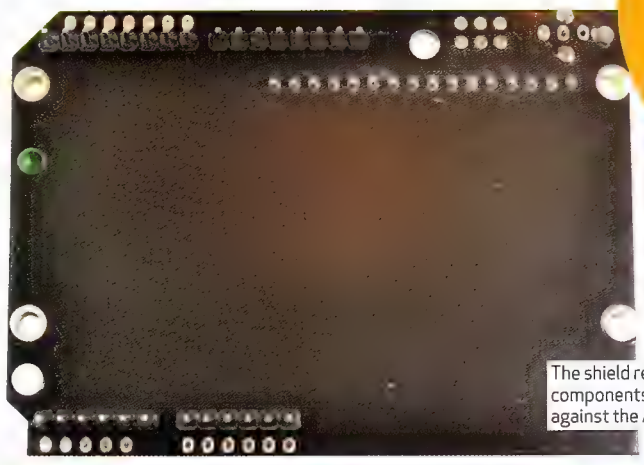
Arduino Digital Clock

PROJECT 13

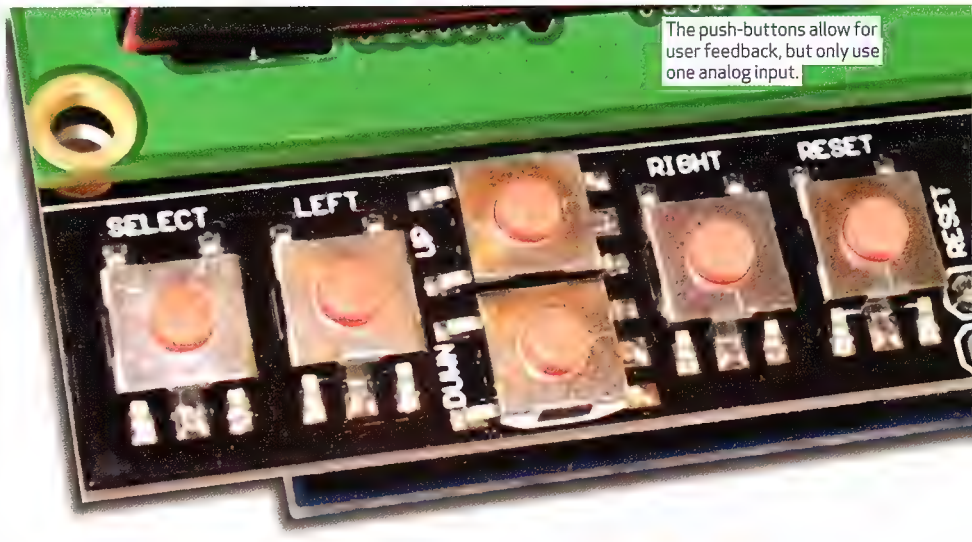
Darren Yates continues his series exploring the Arduino microcontroller, creating a digital clock with a 1602 LCD shield.

Get it
Download the sketch you need for this article from www.apcmag.com/arduino.htm

Arduino is the world's favourite microcontroller board and despite its low 16MHz/8-bit computing power, it can drive robots, connect to Twitter and even power 3D printers and quadcopters. One of the many reasons for its success is the number of expansion boards or shields available. We've already looked at a few including the W5100 Ethernet Shield, along with two motor drive shields – one for DC motors (used in our Rolly Robot project and free-roaming Attacknid hack) and one for servo motors (powering our Stompy walking robot project). But it's the ability to make Arduino handle human interaction that makes it so versatile. We've already looked at how you can connect your Arduino to your TV showing weather information and playing Space Invaders, but there is a low-cost shield that can display data in a far more compact way.



The shield rear has no components so it can't short against the Arduino board.



The push-buttons allow for user feedback, but only use one analog input.

THE 1602 LCD SHIELD

One of the most popular shields is the 1602 LCD Shield. You can find clones of these everywhere on eBay selling for as little as $6 and that includes shipping. The shield itself delivers a smaller daughterboard containing an alphanumeric LCD panel consisting of two lines with 16 characters per line, typically driven by the popular Hitachi HD44780 LCD controller. Throw in five user-programmable push-button switches plus on-board master reset button and you have the 1602 LCD Shield.

These little 16x2 LCD panels have been around for over 20 years – I created a simple project in *Silicon Chip* magazine back in 1993 that connected one to a PC's parallel printer port. But it's only with the introduction of Arduino that they've become so ridiculously cheap. And by integrating the LCD panel into a shield, there's no soldering involved – you just slot it into place using the Arduino's Shield header pins.

The LCD panel is backlit, lighting as soon as power is applied, but it can be turned off by programming. While green-backlit panels are common, there's a growing number of blue-backlit options as well. The six push-button switches are located on the bottom left side with four in a plus-pad arrangement, the outer switch on the left designated as Select and a master-reset button on the far right. Press the reset button and your sketch will restart. You can adjust the LCD contrast by the small potentiometer (or 'pot' for short) at the top-left. Adjust it so the blank pixels are just beginning to darken and back it off a little. There are many different brands of 1602 Shield on the market but they all conform to this basic layout.

So not only do you have a compact display device but you can also handle user feedback, which makes this shield an ideal project companion to any compatible Arduino microcontroller board.

The tiny 10kohm potentiometer (pot) sets the LCD screen contrast.

APPLICATIONS

Again, this is one of those shields whose applications are only limited by your imagination. Normally when demonstrating something for the first time, you do the equivalent of 'Hello, world' program or 'sketch', but to show you how the interaction works, we decided to go a bit further by creating our own

simple digital clock. Some of you may be aware that we have a 3D Printing Masterclass in our sister publication, *TechLife*. We've taken our clock the extra step by 3D printing a case designed for this particular shield, complete with push-button actuators.

PROGRAMMING THE SHIELD

As usual, we're making the sketch available on our web site for this month's project and you'll find it over at **apcmag.com/arduino.htm**. Copy the contents of the /libraries folder to the /arduino -1.0.5/ libraries folder, launch the Arduino IDE and load the sketch file.

There are a few things going on in this sketch but here's the overview – basically we need to display initial information on the LCD panel, handle input via the shield buttons and accurately updating the time display once every second.

LIBRARIES

The 1602 LCD Shield relies on two specific software libraries – LiquidCrystal and LCDKeypad. The very first thing you have to do is initial the LCD Shield so that the Arduino microcontroller knows what you're playing with. And it's here you may find initial problems. While there are many different 1602 Shield clones available, not all use the same pin configuration, so the LiquidCrystal library is designed to allow you to set it to your specific shield. You can read about it at **arduino.cc/en/Reference/LiquidCrystal**. Keeping it short, virtually all 16x2 LCD panels can run over a 4-bit data bus with two extra control pins – RS (register select) and EN (enable).

If you purchase the super-cheap $6 DFRobot shield (like we did), you'll probably find that using pin D8 for RS and pin D9 for EN, along with D4-D7 for the four-bit data bus pins should work. This is outlined in the code line:

```
LiquidCrystal lcd(8,9,4,5,6,7);
```

Once that's done, displaying text on the panel is as simple as setting to cursor position using the `setCursor` command and printing your text through the print command like this:

```
lcd.setCursor(0,0);
lcd.print("Darren's little");
lcd.setCursor(3,1);
lcd.print("digital clock");
```

The cursor position is set by (char, row) with each dimension starting with zero, meaning the top line is 'row 0' and the bottom line 'row 1'. There are numerous other functions available as well.

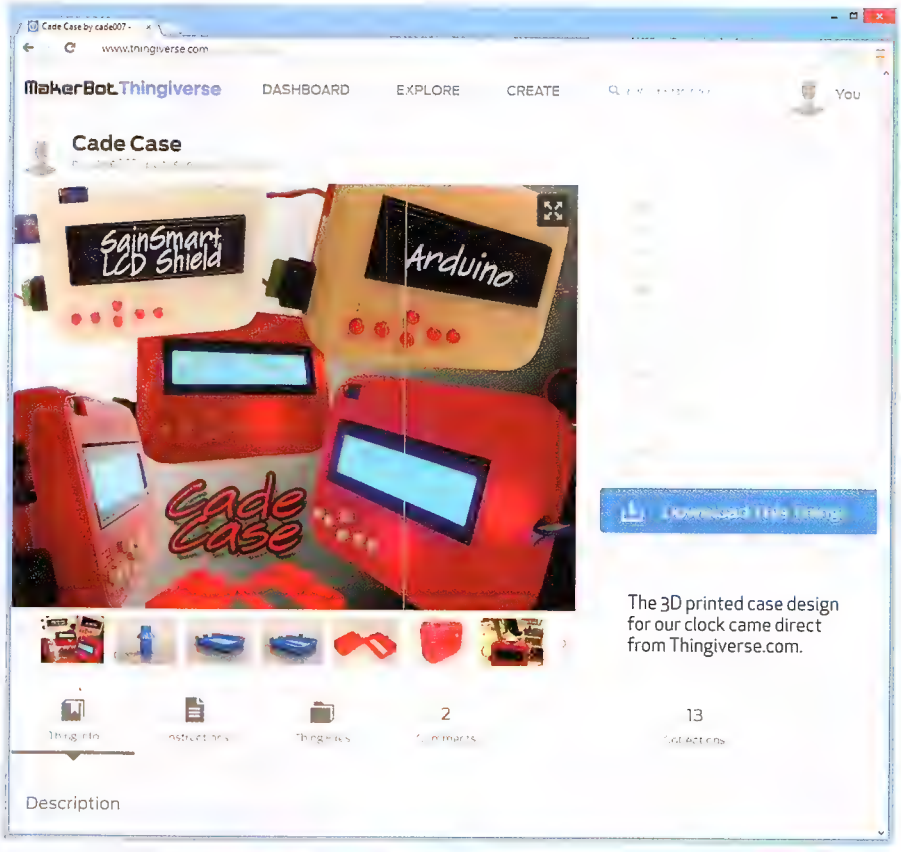
PROGRAMMING PUSH-BUTTONS

One of the more unusual aspects of this shield is how the buttons are electrically connected to the Arduino. Push-button switches are essentially digital in their actuation – they're either on or off. However, with five input switches, you could potentially tie up five digital input/output (I/O) lines to handle them. But instead, the switches are all connected to just one of the analog inputs. When you push one of the buttons, it sets up a specific voltage on the analog input through a resistor network.

Using DFRobot's LCDkeypad library, you can check for these inputs to know which button was pressed and perform an appropriate action. It's a little awkward in how it works but using one input rather than five leaves you more I/O lines for your project. The five analog values are stored in a one-dimension array at the start of the sketch:

```
int adc_key_val[5] ={ 50, 200,
400, 600, 800 };
```

We incorporated a common routine used to check the input value to see which button was pressed.



The 3D printed case design for our clock came direct from Thingiverse.com.

Our digital clock inside a 3D printed case designed for this shield.

HOW DO YOU CODE A CLOCK?

Your PC, notebook, tablet and smartphone all have clock apps built into their operating systems. In fact, clocks are such an important part of where computing meets the real world that special electronic modules called 'real time clocks' (RTCs) have been invented with the express job of simply keeping the time.

When you want a software program

to create a change in some real-world hardware at a particular event, such as a push-button being pressed, you generate what's called an interrupt. As its name suggests, its job is to interrupt the main flow of the software to launch a specific function. Depending on the microcontroller (or CPU), interrupts can be triggered by hardware (a specific input for example) or software.

Our clock keeps track of the year, month, day, date, hour, minutes and seconds. Since the second counter is the smallest unit we need to update, we'll need to ensure it gets updated each second. We don't have an RTC at our disposal so to create the interrupt, we use the TimedAction library like this:

```
TimedAction timer =
TimedAction(1000,clockUpdate);
```

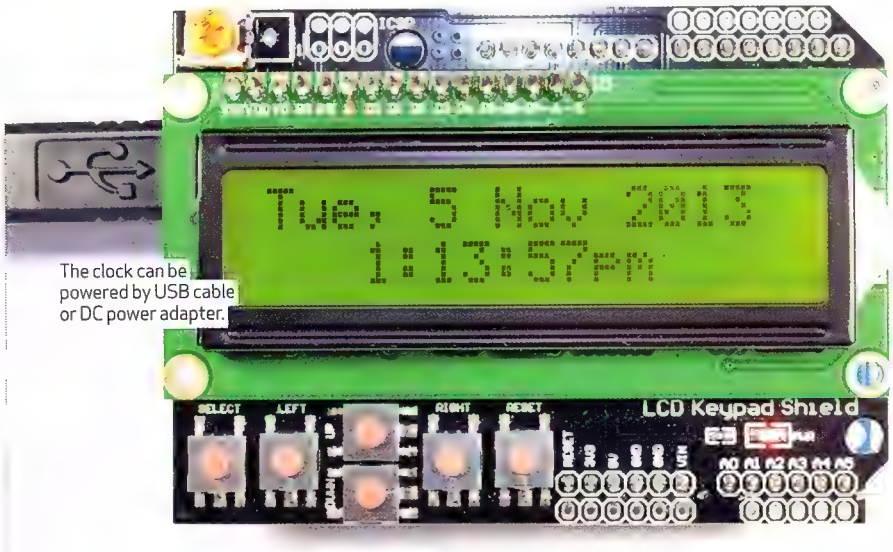
This library allows you to create a repeating interrupt trigger at a program-defined time interval that runs a procedure or function. We use this library to create a repeating interrupt once per second (1000 milliseconds). Each time it triggers, we run the `clockUpdate` code function that increments the seconds counter and takes care of the rollover for each new minute, hour, day, date, month and year.

SETTING THE TIME

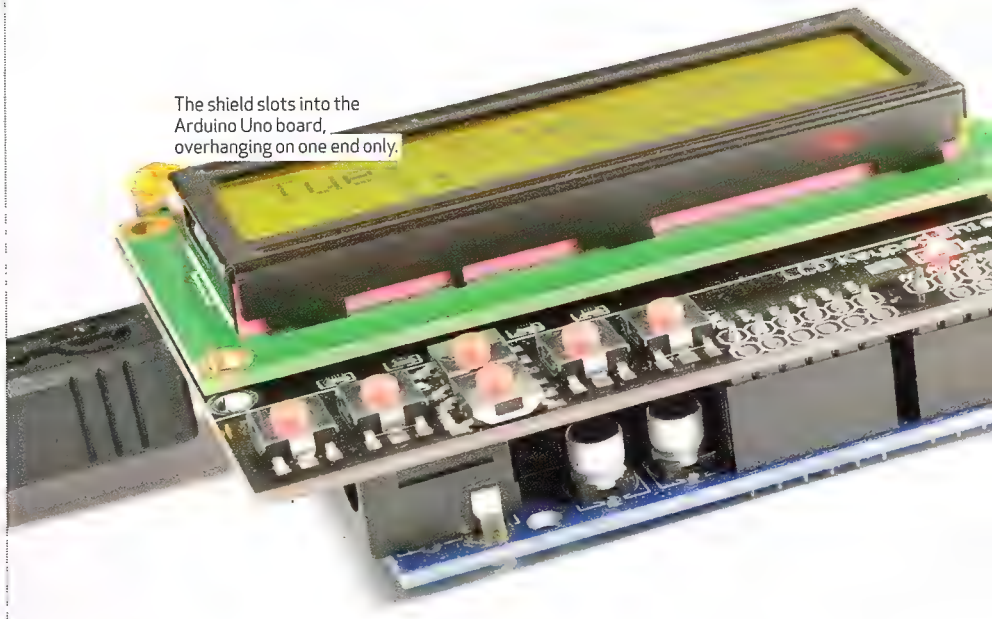
In normal operation, a clock doesn't have to interact with the outside world – except when you're setting the time to begin with. In one way, we've taken a fairly basic approach to time setting – you do this as soon as you power up the Arduino clock through a series of questions you answer for each of the time intervals – year, month, day, date, hour, minute – using the Up, Down and Select buttons to set each option. Once you press the Select button, you move onto the next setting. After pressing it the final time, the clock sketch goes into the time function loop and updates every second.

However, the backroom code automatically sets the correct options for each time interval – for example, you set the month by selecting from January, February and so on; days from Sunday, Monday etc. Once you set the month, you can choose the correct day, which means the code knows that January has 31 days; April has 30, and so on. You can't select 'April 31' for example. It also knows the difference between AM and PM and that there can only be 60 minutes in an hour, 60 seconds in a minute. We do this using a series of two-dimensional character arrays like this:

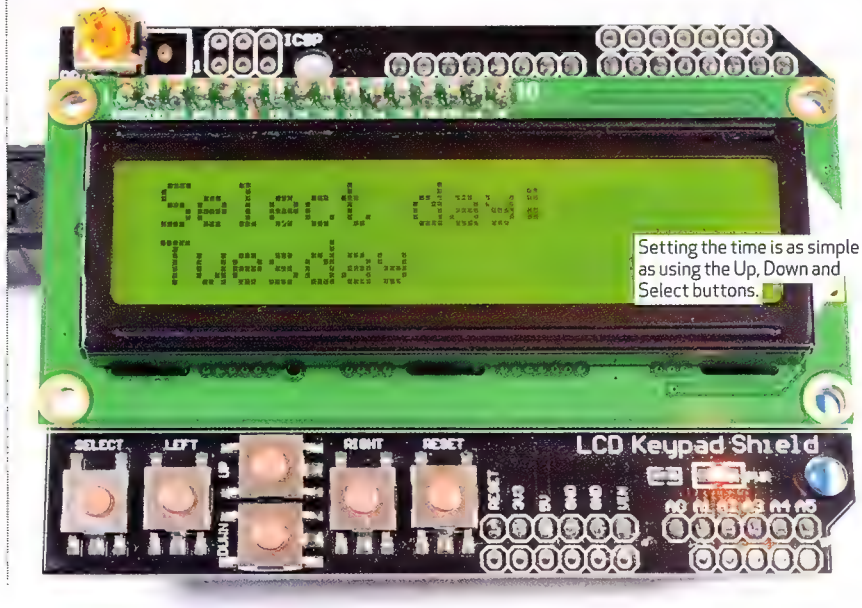
```
char day[7][10] = { "Sunday
","Monday   ","Tuesday
","Wednesday","Thursday
","Friday   ","Saturday "};
```



The clock can be powered by USB cable or DC power adapter.



The shield slots into the Arduino Uno board, overhanging on one end only.



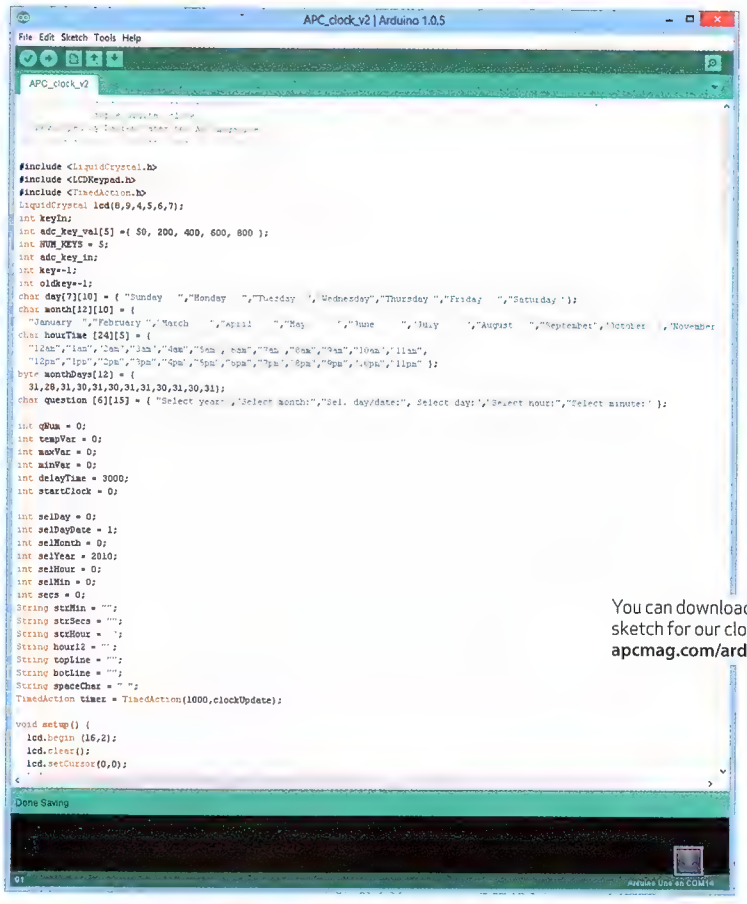
Setting the time is as simple as using the Up, Down and Select buttons.

Here, we're setting up the day options – the array has seven elements, each with 10 characters. Because of the way Arduino works, you must fill the array characters explicitly, which is the reason for the blank spaces in the smaller day names. If you don't, your sketch won't compile for you.

So overall, this is a more complex example of allowing a choice from a limited number of options and varying the options for subsequent input based on previous selections.

What our sketch doesn't do is take into account leap years – we'll leave that as an exercise for you to do. It also doesn't allow for time modification after the initial setup. To do that, you have to hit the Reset button and start again.

Remember, the idea here is to show off the LCD Shield as well as show how to code for it into your apps. The rest is up to you.



You can download the sketch for our clock at **apcmag.com/arduino.htm**.

3D PRINTED CASE

To finish off our clock, we've had a look on **Thingiverse.com** and not surprisingly, there are dozens of brackets and cases designed for various members of the Arduino family. We were expecting to have to buy a small general-purpose ABS plastic Jiffy box from Jaycar Electronics to put our clock in, but someone has designed a case specifically to use this Arduino/Shield combo, so we printed it out on our Printrbot Jr 3D printer. You can check out the case at **www.thingiverse.com/thing:132497**.

INSTALLATION

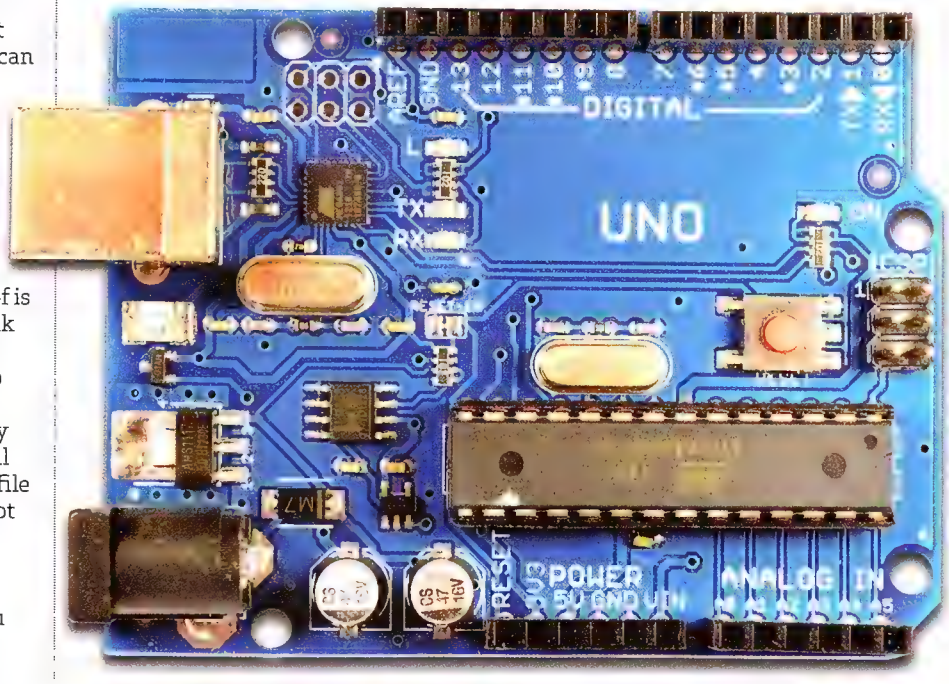
You don't need to screw the Arduino/Shield combo into place in the case – it will sit in position on its own once the two shell halves come together. The only thing you need to be careful of is the two retention clips. These can break so don't press the clips – press on shell either side of the clips to compress it so the clips will lock into the base. Make sure the button actuators move cleanly inside their holes too, otherwise, they'll jam up the switches. Use a small wood file to open the holes as necessary – just not too much or the actuators will fall out.

POWER

The clock consumes little power so you can either grab a simple 5VDC/200mA power brick with the right 2.1mm DC plug or you can get a cheap USB phone charger and power the clock through the USB port. Either way will work just fine.

MODIFICATION IDEAS

The sketch code for this clock we threw together in a day is more a demonstration of how the 1602 Shield works. But if you want to modify it, go right ahead. Improvements we can think of straight away are:



Arduino Uno R3 clone boards now sell for under $10 including shipping on eBay.

- a simpler time-adjustment system without resetting
- battery backup
- automatic backlight dimming
- programmable alarm with snooze
- FM radio

Sure, you can buy a clock radio that does all of this but where's the fun in that? We don't care what anyone says – the best way to learn is by doing and there's plenty of scope for exploring ideas in this project. For example, you could use the Arduino to control another device via a user-settable alarm time – it could be your bed-side lamp or your coffee maker. That's well beyond the entry-level hobbyist but it just takes a spark of imagination to come up with your own ideas.

How to fake an Android device

Darren Yates shows you how to get around a Google Play app's supported devices list by faking a different Android device.

Google Play is an Aladdin's cave for Android phones and tablets, but depending on your device, you may find some of its treasures hard to find. While the app store lists which versions of Android are supported by a particular app, having one of those versions is no guarantee it will install as Google Play may still decline to even show the app as an option.

For the most part, that comes down to a developer decision on which devices are supported.

There's little you can do if your device doesn't have the required hardware, but being told your device is not supported, when it otherwise might be, is annoying to say the least. Sometimes, there are good reasons why developers will limit installation apart from hardware compatibility – it may genuinely be that a device lacks some software feature or has proven to be an issue for some reason. Sometimes, it can be the app runs less than optimally on a device, so the developer decides to cut it from the list to save themselves the 'one-star review' headaches.

However, the problem with this is that it can also cut out newer devices that may well run the app quite happily. We had an example of this in our recent story on installing Android 4.3 on your PC. After installing the OS successfully on a Compaq CQ42-136TU notebook, we couldn't get *Angry Birds* to install – not because our notebook wasn't capable of running the game but because it wasn't on the app's supported-device list. While it's somewhat understandable, given Android wasn't originally meant to run on a 1.9GHz Intel Celeron-CPU-based platform, it's an example of what can be wrong with the current device support list system in Google Play. The system appears designed to take a very conservative stance to unknown devices, knocking them off if it doesn't recognise them, rather than allowing users to install apps and find out for themselves whether they work or not. But given that apps live or die by their review ratings, it's not surprising the store errs on this conservative side. Still, it may be designed to keep newbies out of trouble, but we think it's too arbitrary for more experienced users.

One common trick around this is to try and get Google Play to install the app by 'pushing' it onto the device through the Google Play web browser edition, but that only works if the device is on the 'supported' list.

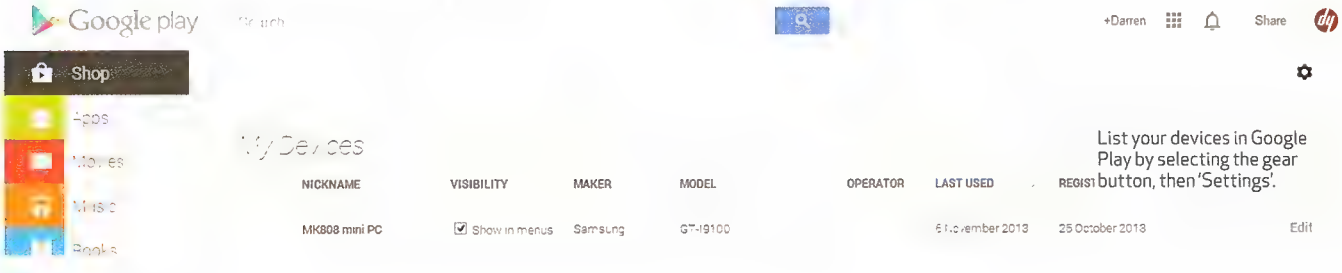
FAKING A DIFFERENT DEVICE

However, there can be a way around it – and that's to try and make your device look to Google Play like something else or, putting it another way, 'faking' another Android device. Back in our Android 4.3 story a couple of months ago, we looked at the Market Helper app (not the one on Google Play) that performed this trick for us, but this month, we'll look at a non-app option that may fix this issue.

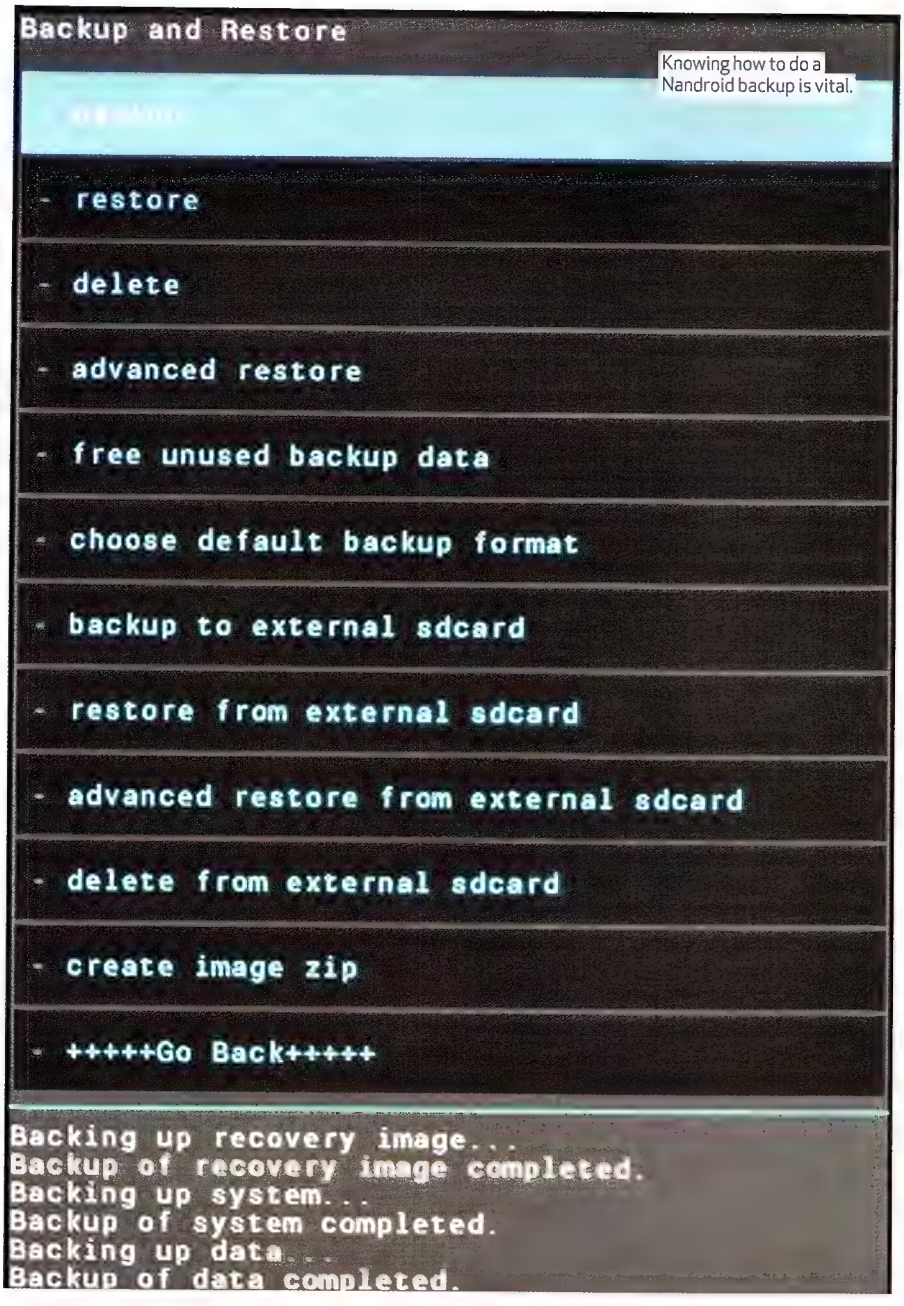
The key is a file in the /system folder of your device's Android operating system called build.prop. It's a text file Android uses to define many settings within the

The MK808 mini PC cannot install *FIFA 14* because of 'compatibility issues'.

Faking the device to a Galaxy S2 smartphone, the install lock is removed.



List your devices in Google Play by selecting the gear button, then 'Settings'.



Knowing how to do a Nandroid backup is vital.

operating system, everything from video recording rates to faster booting. Think of it like the old config.sys file from DOS/Windows 95 days.

But because it is so important to your Android device, it's vital you don't make wholesale changes unless you understand exactly what you're doing – mucking up this file could see your device stuck in a boot loop, requiring an OS re-flash.

All you need to edit the file are root access and a file manager with /system write access – you can try the free ES File Explorer or Root Browser or the payware Root Explorer apps from Google Play – you don't need a PC or any other specialised app. Unfortunately, root access is required for any process that modifies the build.prop file, but using our manual method, you're more in control of the process.

FIRST THINGS FIRST

Before you go making any changes to build.prop, you must make a full Nandroid backup or use ROM Manager to make a full backup of your device just in case everything goes pear-shaped. That means you must also know how to restore that backup if the process falls in a heap. In addition, we suggest you also make a local copy of build.prop for reference.

If you stick to the changes we describe, you should be fine, but there are no guarantees – you do this at your own risk. And just in case you have to ask, this isn't a process we recommend for Android newbies.

CHANGING SETTINGS

Google Play makes decisions about your device based on a number of build.prop settings:

Adding build.prop tweaks to your ROM

If you've been following our 'Making your own ROMs' masterclass over the last few months, build.prop tweaks are something else you can add to your ROM manually. Once your ROM is expanded into its working directory, you'll find the build.prop file in the /system folder. Make your changes (carefully) and save the file. They'll be enacted when you build your ROM and flash it to your device. Again, just make sure any tweak you use will work with your device before you flash it and make a backup copy of build.prop before you build your final ROM.

Samsung's Galaxy S2 is a popular choice to fake devices to.

ro.product.model
ro.product.brand
ro.product.name
ro.product.device
ro.product.manufacturer
ro.build.fingerprint

The first five are simply make-and-model references, while the last one is an ID link or 'fingerprint' that details the

legitimacy of your device.

Now depending on what you read online, plenty of users are claiming it's enough to simply change the ro.product pairs to fake another device. However, for every claim like this, you read four or five replies saying it doesn't work. Our theory is that there's likely to be more than one factor involved.

In fact, the more you look into it, the more important the ro.build.fingerprint appears to be. Every Android device provides its own ro.build.fingerprint key link. We think the key to faking another device increasingly lies with ensuring you use a ro.build.fingerprint from the device you want to fake to. We've used this technique successfully to turn the popular $50 MK808 TV-stick mini PC into Samsung's Galaxy S2 smartphone and begin downloading games such as *FIFA 14* that wouldn't download otherwise. However, it appears that newer versions of Android are having less success with this method – we're not sure why at this stage, but we think it may just be a change in the requirements for successful faking. We don't think Google has stopped it. The Market Helper app doesn't edit build.prop but uses a similar technique and we know it still works – at least with Android 4.1 devices.

HOW IT'S DONE

Mechanically changing the settings is simple – you open build.prop on your rooted device inside your file manager with any text editor, change the ro.product and ro.build.fingerprint pairs to the new device you want to fake and save the file. After that, you go into 'Settings > Apps', clear the data and cache options for Google Play Store app and immediately reboot.

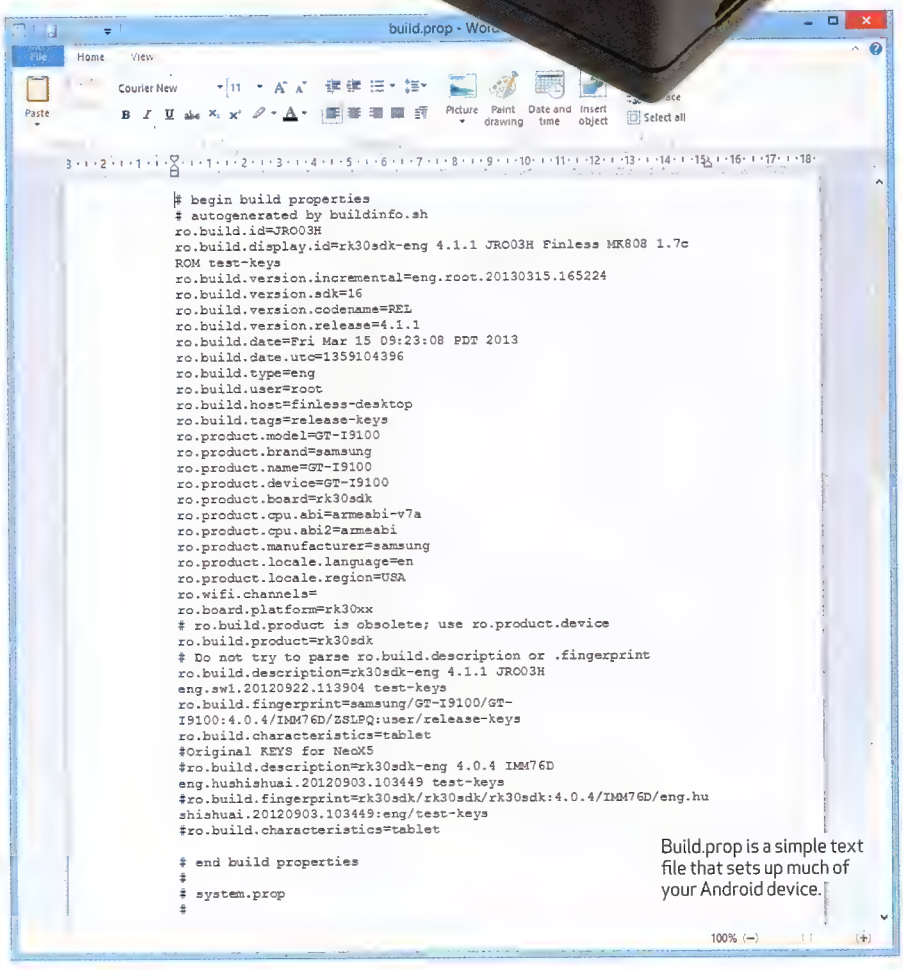
For example, part of our MK808 mini PC's original build.prop file goes from:

```
ro.product.model=MK808
ro.product.brand=rk30sdk
ro.product.name=rk30sdk
ro.product.device=rk30sdk
ro.product.manufacturer=rockchip
ro.build.fingerprint=rk30sdk/rk30sdk/
rk30sdk:4.1.1/JRO03H/eng.
lfwang.20121026.092031:eng/test-keys
```

and becomes:

```
ro.product.model=GT-I9100
ro.product.brand=samsung
ro.product.name=GT-I9100
ro.product.device=GT-I9100
ro.product.manufacturer=samsung
ro.build.fingerprint=samsung/GT-I9100/
GT-I9100:4.0.4/IMM76D/ZSLPQ:user/
release-keys
```

The MK808 dual-core mini PC sells for around $50 on eBay.



Build.prop is a simple text file that sets up much of your Android device.

However, in this instance, we also need to check other parts of build.prop to ensure they match the new settings. For example, the ro.build.tags setting here should be changed from `test-keys` to `release-keys`. Android authentication allows two sets of fingerprint keys, one for testing and another for general release and the ro.build.tags should match the fingerprint key type being used. In the example above, you can see the key type change at the end of the last line goes from `test` to `release`.

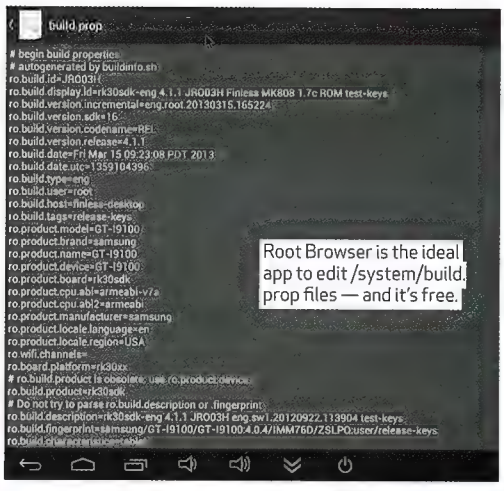
One last thing, when entering the manufacturer, it's important that you get case right – it's `samsung` with a lowercase 's', for example. To fake an LG phone, the manufacturer settings has to be `LGE`, all uppercase. Take your cues from build.prop files you find online from web sites like **xda-developers.com**.

WHAT YOU DON'T CHANGE

It's vital that you don't change any settings that relate to the current version of Android being used by your device. Settings such as ro.build.version.sdk and ro.build.version.release must stay as they are. We changed them to see what happened – all you get is a permanent boot loop. That makes sense because you're trying to tell the device it runs an Android version other than what it has – never a recipe for good times.

ACTIVATION AND DELAY

Now one thing that caught us out early on was that when you go through changing the build.prop settings and reboot, you have to go into Google Play and download an app – and it seems to be any app – to get the Google Play servers to register your 'new' device. There's also a time



delay in this new re-registration — we've seen it take several hours before Google Play servers get updated.

The MarketHelper app from our 'Android 4.3 on PC' story, on the other hand, bypasses build.prop and sends information changes straight to the Google Play servers using JSON (Javascript object notation). But the changes only last until you reboot your phone and your build.prop settings override. By editing build.prop, you're making these changes permanent (until you change your build.prop file again).

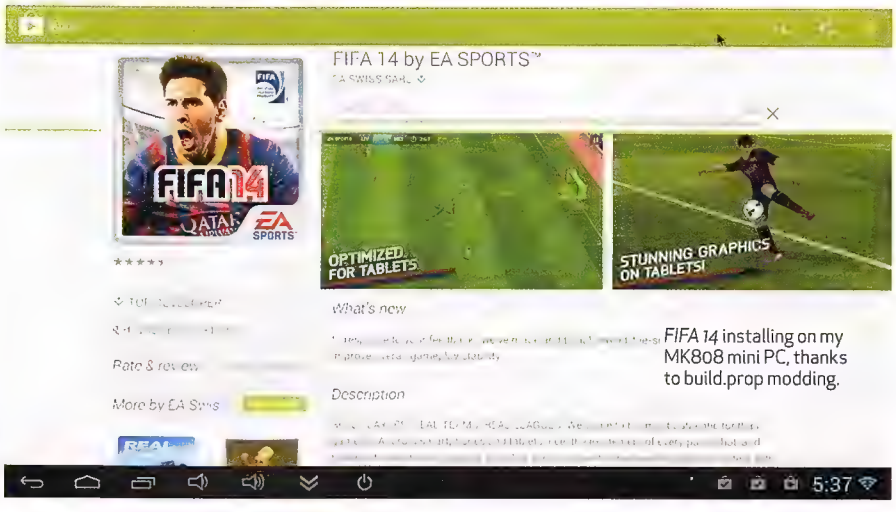
CHOOSING AN ALTERNATE DEVICE

But when it comes to faking a different Android device, the big question is which device should you choose? Obviously, you want to choose a device more popular than your own, but also something that is a reasonable match in terms of hardware to your own device (and one that's popular with app developers). For that reason, we suggest starting with Samsung's Galaxy S3 or S2 phone. The S3 arrived with Ice Cream Sandwich (Android 4.0.x) so if your device is stuck with an older ICS ROM, it should still work. If you're running Gingerbread (Android 2.3.x), try the Samsung Galaxy S2.

The real trick is to find the appropriate ro.build.fingerprint key for the device you choose. New keys are issued for each new ROM release — but you must use one for an Android release that is no newer than the one your device is running. For example, if your tablet is running Android 4.1.1, avoid choosing a ro.build.fingerprint key for an Android 4.1.2 release.

FIND FINGERPRINT KEYS

Fingerprint key links aren't too difficult to find with a bit of Google-sleuthing. We just searched for 'GT-I9100 ro.build.fingerprint 4.1' and found a number of them, most from forums and web sites like **xda-developers.com**. Here are three keys we've found for the GT-I9100 (Galaxy S2): samsung/GT-I9100/GT-I9100:4.0.4/IMM76D/ZSLPQ:user/release-keys



FIFA 14 installing on my MK808 mini PC, thanks to build.prop modding.

samsung/GT-I9100/GT-I9100:4.1.1/JRO03H/XXLPQ:user/release-keys

samsung/GT-I9100/GT-I9100:4.1.2/JZO54K/I9100UHMS8:user/release-keys

DOES IT WORK?

The one thing to remember is that faking a device through build.prop is as much a 'black art' as it is a science — and that's because it still relies on your device having the hardware requirements to make an app work. If your device runs at least a recent ARM Cortex A9-series CPU with Mali-400 graphics, the chances of an app actually working improve significantly. By changing build.prop, you're really just trying to get Google Play to recognise your device as something more common. But changing it doesn't all of a sudden make your hardware compatible — that has to be a prerequisite if build.prop changes are to have any effect at all. For example, the MK808 mini PC runs Rockchip's RK3066 dual-core Cortex A9 CPU with quad Mali-400 GPUs. Spoofing a Galaxy S2 here is just getting Google Play to recognise the device and allow app installation and it worked for *FIFA 14*. What certainly helps is that the core CPU/GPU hardware of both of these devices is very similar.

Device-spoofing apps

If you'd rather just bypass the whole process and use an app, we know of at least two:

- Market Helper — **http://codekiem.com/market-helper/latest**
- Device Spoofer — **https://play.google.com/store/apps/details?id=com.scheffsblend.devicespoof**

Unfortunately, while device faking can be a help, it's not a silver bullet.

NEXT MONTH

Device faking is just one use for build.prop, which is one of the most important files in any Android device. With the file holding so many Android settings, there's been considerable work done on finding generic system/performance tweaks through build.prop tweaking. Next month, we'll start looking at some of these tweaks, what they are and how they work.

Beams of light are dazzlingly beautiful in *BF4*

apc HOT PRODUCT

FROM $90 | XBOX 360, PS3, PC, XBOX ONE, PS4 | WWW.BATTLEFIELD.COM

Battlefield 4

A lot of buildings get broken, but not much new ground.

Battlefield 4 wants you to break it. Demolition has been, to varying degrees, the series' distinguishing feature ever since *Battlefield: Bad Company 2*. In BF4 it takes the form of massive, shatterable centrepieces in each multiplayer map. A concrete dam you can ruin. A dentable radar telescope. A crippled navy destroyer that can be run aground in Paracel Storm.

At some point though, I stopped caring about toppling tower blocks. The 'sky scrapers' I love are the jets. The sound they make is the best sort of distracting. It's a ragged crackle of bass, like a thunderstorm being dragged against its will.

This continues to be one of *Battlefield*'s most enjoyable traits. The disaster-movie destruction is initially novel, but it's the incidental moments of wonder that hold up over time. The blur of wind as you basejump off a roof. The growl of an ATV as its tyres chew grass. The clink of an M40A5 bolt shifting back into place. DICE is the Mozart of war, and its mastery of sound continues to define *Battlefield*'s moment-to-moment richness.

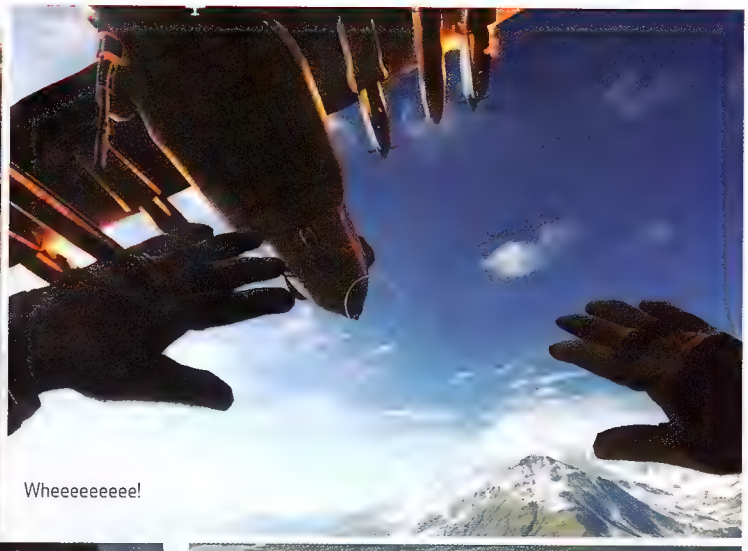
DEJA VU

But this is nothing new, and neither is a lot of BF4. It's still a 64-player, infantry-driven FPS fought on expansive outdoor maps, with a garage of air, ground and sea vehicles to taxi you between capture points, and the weapon roster is essentially untouched. I understand why DICE wouldn't deviate from its design – why change weapon handling that continues to rest comfortably between accessible and nuanced? Why throw out modes that already suit the maps and mechanics? All the same, you should factor in this familiarity if you tired of BF3 quickly: BF4 will probably age faster than its predecessor.

Keeping some of that sameness at bay are features like Commander mode – a strategic role returning from BF2142 that one player per team can assume instead of fighting. Commanders view the match omnisciently through a fullscreen map, issuing attack and defend orders while phoning in what are essentially killstreaks as they're earned by squads. These 'commander assets' are powerful in the right hands, as they include everything from air-dropping ammo and health to temporarily spotting all enemy infantry or summoning an AC-130 gunship. The latter makes you feel like Zeus: lobbing cannon rounds from on high is a wonderful break from being a pair of boots on the ground, and it takes real skill.

Outside of this strategic role, there's a new hybrid bomb-planting and capture-point mode that I like. Obliteration joins the compact Rush, longer-form Conquest and team deathmatch modes. It's a meat-grindery back-and-forth that occasionally resembles rugby more than it does a battlefield, but in a good way.

The vehicle set is mostly unchanged, save for a neutral MLRS truck that spawns on a few maps. Controlling it gives your team mobile artillery to knock out hunkered-down defenders or disrupt vehicle advances. The truck is


Wheeeeeeeee!

balanced with a limited firing arc and long ammo-regeneration timer, and by separating the driving and firing positions.

BF4's 'Levolution moments', as EA calls them, are presented as the main attraction. These scripted setpieces only subtly influence matches, which I appreciate. One of the better events in Paracel Storm isn't the wrecked warship that you can run aground, but the way the sky shifts from a clear, tropical postcard to an oily hurricane. The ocean gets choppy, and travelling on jetskis and boats is more of a chore.

At the less ambitious end of the Levolution spectrum is Golmud Railway. The dynamic element here is a small train that happens to be one of the six capture points. This might've been a nice idea on paper, but the train is easily intercepted and has almost no strategic value.

HOTEL HAINAN

Gimmicks aside, the layout and look of BF4's maps is great, with some standing alongside the series' best. Hainan Resort is my favourite – a tropical bay overlooked by a hotel. LAVs inevitably stack up in the courtyard at the lip of this resort, generating some excellent cat-and-mouse between armour and engineers while gunboats harass from the shore.

Naval combat is more abundant in BF4, expressed in maps such as Flood Zone, where you fight on the rooftops of apartments submerged in 50 feet of swimmable water. And Golmud Railway, while a drag in Conquest, is fantastic in Rush, which shrinks the map to a concentrated attack-and-defend format. The exception to the well-designed map rule is Operation Locker – a flat, bottlenecky industrial bunker. If you enjoyed BF3's Operation Metro you'll love it, but it's my belief that BF doesn't play well in compact spaces. Even with just 28 players, an Obliteration round on Locker devolved into a 40-minute meat-grinder. Small crowds would gather at metre-wide tunnels, players dying in piles.

The campaign is better than BF3's dismally generic offering, although it's still single player-by-numbers. You're a marine, leading an elite team of tactical experts who all continually need your help to open doors. Amid political strife in China, you're sent to extract a VIP. It goes awry, sparking open conflict with the US. The action never deviates from the whack-a-mole game of plunking down pop-up guards, punctuated by cutscenes and the odd helicopter or tank kill.

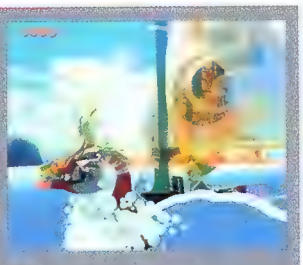
On the technical side, it was frustrating that I couldn't widen the campaign's FoV, which is locked at around 70. I also found the inclusion of kill counters in singleplayer strange. DICE is certainly guilty of taking an 'if it ain't broke' attitude, but BF4's refinements and excellent maps are enough to make it one of my favourite FPS games. A cynic would call it a map pack in sequel's clothing. If that's your judgment, know that it's one with enough variety, depth and quality to survive a year of intense play.

■ Evan Lahti

Verdict

Very similar to BF3, but improved by the new Commander Mode, plus a terrific and diverse map selection.

★★★★½



The Legend of Zelda: The Wind Waker HD

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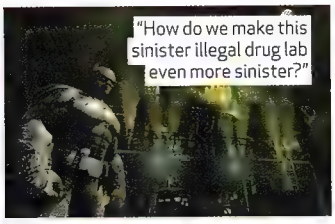
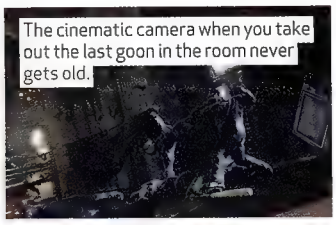
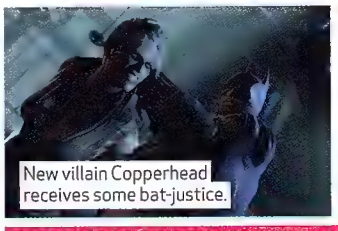
The crime scene reconstruction is nice-looking, but shallow.


"How do we make this sinister illegal drug lab even more sinister?"


The cinematic camera when you take out the last goon in the room never gets old.


New villain Copperhead receives some bat-justice.

Batman infiltrates the Gotham PD building.

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Batman: Arkham Origins

The Dark Knight plays it safe in a disappointing prequel.

Arkham Origins joins Batman in his angsty teenage years. He's not the stoic, Kevin Conroy-voiced Bats of Asylum and City, but a hot-headed vigilante who punches first and asks questions later. It's an interesting twist on the Arkham formula, but despite the change of tone and time period, this is a disappointingly timid retread of Rocksteady's games.

It's Christmas Eve, and skull-faced mobster Black Mask has given the caped crusader an early present in the form of a $50 million bounty on his head. Eight assassins have been hired to claim the prize, including Bane, Deathstroke and Killer Croc, plus a parade of low-rent DC villains.

The city is noticeably bigger than before, but less visually interesting or as fun to navigate. There are too many dead ends that break your flow as you're gliding, and the new island is a grey, uninspiring industrial sprawl. The missions are formulaic and linear, with none of the previous games' careful pacing; you're hastily pushed between predator challenges and fights, rather than progressing organically, at your own pace.

At first I thought the combat was unchanged, but the more I played, the more aware I became that it was actually worse. The controls and animations are the same, but the sporadic attack patterns rhythmic tempo and combat flow is wrong.

A new feature I like is the *Devil May Cry*-inspired rating system. After each fight, the amount of XP you're awarded is dictated by your performance. If you used a lot of variety, mixing gadgets (there's a few new toys to play with) and combos, you'll earn more.

Facing off against this shopping list of famous *Batman* baddies should have been a highlight, but they're probably the worst thing in the game. Most involve learning and exploiting a handful of very basic patterns, while regular enemies are occasionally thrown into the arena in a half-hearted attempt to add variety.

The old Detective Mode has been reworked, enabling you to reconstruct crime scenes with holograms and scrub through them for clues. It looks great, but is pretty shallow. You're still just holding a button to scan things. Batman does the detecting; you just tell him where to look.

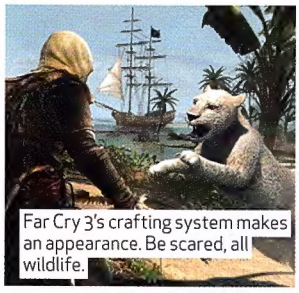
Multiplayer sees two three-man teams of thugs battling each other while a third team, Batman and Robin, try to take them out. Thugs fight over *Battlefield*-style control points, and can call upon Bane and the Joker to help out. It's enjoyable enough, and the predator system works well against real players, but after only a few hours I don't feel any urge to return to it.

The best thing *Origins* has in its utility belt is the story. It's nothing we haven't seen in a thousand films, games and comics before, but it's confidently written, well-acted, taking influence from established mythology without copying it.

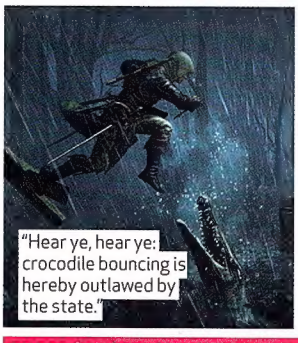
The leap from *Asylum* to *City* was dramatic, if not entirely successful, but *Origins* is so similar to *City* that it feels more like an elaborate expansion than a proper sequel. ■ **Andy Kelly**

Verdict

Enjoyable in places and very pretty, but sadly blighted by sloppy design, terrible boss battles and a lack of new ideas.



Far Cry 3's crafting system makes an appearance. Be scared, all wildlife.



"Hear ye, hear ye: crocodile bouncing is hereby outlawed by the state."

Once an enemy ship is on fire it's ripe for boarding – kill the crew to plunder all resources.

FROM $80 | PC, XBOX 360, PS3, XBOX ONE, PS4 | ASSASSINSCREED.UBI.COM/

Assassin's Creed IV

Ship-shape up top, but problems still persist below deck.

For a franchise with this particular title, it's peculiar how few of the games in Ubisoft's Templar-hunting series have actually been centred on killing. Or, more specifically, as there is a hell of a lot of death, contract killing. Assassinating, if you will.

While *Assassin's Creed* may not be as stabby-stab as it once was, when judged on different terms, this fourth installment (subtitled *Black Flag*) is a hugely impressive, vast, enjoyable and absolutely gorgeous game. There is so much to do that this will keep you going until long after you've endured yet another underwhelming Valentine's Day.

The wealth of content is such that the main storyline, somehow simultaneously too simplistic and too complex, is almost the sideshow. Across a gargantuan map you go harpooning, freedive to explore sunken wrecks, discover treasure maps, gather collectibles and lay siege to forts. And that's just some of the naval-oriented action: on land you complete assassin contracts, synching viewpoints, performing Templar Hunts, collecting sea shanties and culling wildlife to fashion fetching outfits.

Oh, and you also undertake missions to further a semi-supernatural plot, as boisterous pirate Edward Kenway (grandfather of ACIII lead Connor) hunts down a precious artefact lest it fall into the wrong hands. Which is basically the narrative for every single game in the series. Thankfully here the cast of characters is far more interesting and more varied than last time out, and some of your nefarious pirate chums are excellent to interact with.

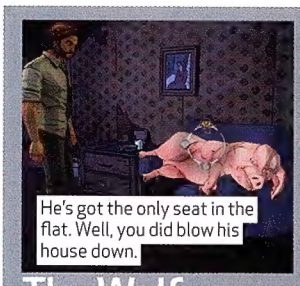
The opening as a whole is fantastic. Normally AC games feel like an extended tutorial for the first eight hours, but this strikes that tricky balance of opening up very quickly, while still unfolding the ways you can interact with your surroundings at a steady and appealing rate. It takes little more than an hour or two for practically the whole map to be fully explorable. The game's three major cities – Nassau, Kingston, and Havana – are all comparable to Assassin's Creed III's main hubs, but then there are dozens and dozens of other locations, ranging from large swathes of Aztec-style jungle, to postage stamp-sized sandcastles containing little more than a tree and a treasure chest. Visiting them all, let alone hoovering up the myriad collectibles contained within, would be a full-time job.

So this is a beautiful, sun-drenched idyll in which you never want for something to do, and as such *Black Flag* is an excellent pirate fantasy. However, the core game is undermined by issues which should have been booted out of the franchise years ago. Eavesdropping missions have always been abysmal, and there's a boatload of them here. And we won't even start in on the fidly camera and environmental inconsistencies with free-running. However, *Black Flag*'s cocktail of Caribbean capers is so large that the effect is like dropping a shot of tequila into a fishbowl of Sea Breeze. You know it's there, and would rather it wasn't, but still enjoy the journey regardless. Despite the nausea. ■ **Joel Gregory**

Verdict

A disappointing ignorance to key areas that need fixing, but this is mitigated by a vast and beautiful world full of possibilities.

★★★★½



He's got the only seat in the flat. Well, you did blow his house down.

The Wolf Among Us Episode 1: Faith

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And they all lived crappily ever after. Telltale's latest turns the page on your favourite childhood fables; humanised and given a fresh start in New York City, Snow White, Mr Toad and the rest find themselves living in abject poverty in the seedy core of the Big Apple. Oh, and there's a serial killer loose amongst them, too. As Sheriff Bigby Wolf, you're tasked with restoring the peace and bringing the killer to justice. The only point of contention is, will you have to resort to your lupine side to do it? After *Walking Dead*'s focus on diplomacy and sacrifice for the greater good of the group, TWAU cuts you refreshingly loose, allowing you to forge your own way to the finish line without having to play nice to jerks. But of course, you can if you want to. But yet there's something missing. *Walking Dead* will likely always be the yardstick by which Telltale's point-and-click adventures are judged, and despite violent fight scenes and a grimy setting it lacks the underlying menace that made *Walking Dead* so gripping. The absence of Clementine as a moral compass is also keenly felt; without her wide, innocent eyes judging your every move, what motivation is there to be neighbourly to a free-loading giant pig? It's not Telltale's best, then. Yet. Opening with punchy dialogue and closing with a stunning cliffhanger, TWAU sets up Episode 2 with style. Just try keeping this wolf from our door. ■ **Alex Dale**

The tablet that ate the world

They say that tablets are a luxury, but this is ridiculous! Panasonic's Toughpad 4K Tablet, which is slated (ahem) for release in the US in January, offers a stupendous 20-inch display sporting 3,840 x 2,560 pixels for your eye-boggling pleasure. At 20 inches diagonally – a size more akin to most people's desktop PC monitors than their mobile tech – it's essentially the display girth of four iPads in one – and at 2.4kg you'll be feeling it, too. The Toughpad 4K rocks Windows 8.1 Pro on an Intel Core i5 CPU with 8GB RAM, a 256GB SSD and a nifty NVIDIA GeForce GT 745M thrown in for good measure. An outright steal at US$5,999. Oh, and because it's a Toughpad, it's also a tad drop-proof. Not that you should make a habit of things like that, butter fingers.

500MB of anticipation

Once upon a time, you'd buy a game console, bring it home from the shops, unbox it, marvel at the sleek unquestionable console-ness of your brand-new toy, plug it in and play some super-neat video games. That order of events pretty much held sway from the heady days of the Atari 2600 up until – *we think* – sometime in 2013. Alas, no longer. As no doubt some of you have discovered by now, Microsoft's new Xbox One released in November requires a hefty -500MB system update via the web before it will basically do anything for you (including not playing the aforementioned super-neat video games). But hey: that'll just give you a little extra time to bask in that sleek unquestionable console-ness. Be grateful for those precious moments.

Audio begone

We've all been there. You're in the midst of a web browsing session when suddenly your computer starts making unexpected noises: a song or video has started auto-playing in one of those darned browser tabs you've got open, *but which one is it?* Chrome, which believe it or not is now up to version 32 – geez, they sure grow up quick these days, huh? – has the cure for what ails you. The latest release of Google's popular browser sports visual markers for browser tabs that are streaming audio, enabling you to silence that pesky upstart quick smart! That'll teach 'em.

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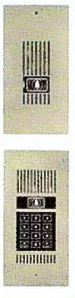

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